Carleton University

1976–77
Calendar

Faculty of Graduate Studies
and Research

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and Research
1976–77
Calendar

As this Calendar is published several months before the opening of the session, the University reserves the right to make whatever changes circumstances may require, including cancellation of particular courses.

Carleton University
Colonel By Drive
Ottawa, Canada K1S 5B6
(613) 231-4403

Office of the Dean

Room 215, Paterson Hall
(613) 231-4403

Dean of Graduate Studies and Research
Gilles Paquet

Assistant Dean
Donald M. Pattison

Administrative Secretary to the Dean
Ruth Corkran

Administrative Assistant (Research)
Anne Burgess

Administrative Assistant (Graduate Awards)
Eleanor Curry

Administrative Assistant (Admissions)
Marjorie Mix

Office Hours
September 1 to April 30
9 a.m. to 12 p.m.
1 p.m. to 5 p.m.

May 1 to August 31
8:30 a.m. to 12 p.m.
1 p.m. to 4:30 p.m.

The University also publishes the Undergraduate Calendar available from:

The Registrar
Carleton University
Ottawa, Canada K1S 5B6

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Carleton University

Ottawa, the capital of Canada, is a medium size, nonindustrial city located at the junction of the Ottawa, Gatineau and Rideau rivers. Excellent skiing facilities, water recreation areas, and scenic areas are located in the Gatineau Hills a few minutes away from the campus. The National Arts Centre with its own orchestra, the National Gallery of Canada, and other such institutions give the city a well-rounded cultural environment. Entertainment is available in both of Canada's official languages, French and English.

Carleton was founded in 1942 as a nondenominational, private and co-educational college. Initially Carleton occupied scattered rented quarters in downtown Ottawa but by 1946 it had moved to a permanent building in central Ottawa. As the University expanded, it became necessary to plan and develop a new campus. In 1954, the University moved to a new campus located on a large and picturesque site between the Rideau River and the Rideau Canal.

Carleton awarded its first degrees in 1946, but it did not offer programs of graduate studies until 1954. Carleton's first undergraduate degrees awarded in 1946 were in journalism and in public administration; its first graduate diploma in 1954 was in public administration. By now, 22 years after the beginnings of its graduate studies, Carleton University also offers graduate instruction leading to the Master's degree in some thirty areas and to the doctorate in a dozen fields. In 1975-76, Carleton registered over 700 full-time graduate students. In addition, over 500 students were registered for part-time graduate studies.

Carleton has set as its major goals in graduate studies the promotion of a spirit of independent investigation and the pursuit of scholarly work of consistently high quality. By concentrating on certain fields of studies to the exclusion of others and by electing areas in which it had a comparative advantage, Carleton has been able to ensure a great measure of success in the pursuit of these goals.

Carleton University has a good base of operation at the graduate level: outstanding scholars, challenging and imaginative programs of studies, students of high quality, libraries, laboratories and other research facilities. Moreover, the location of the University in the capital of Canada also enables graduate students to have access to the vast number of scholars working in government organizations and departments and to take advantage of research and library facilities associated with these national institutions.

Degree Programs

The following graduate programs are currently offered at Carleton:

Graduate Diploma in Public Administration (D.P.A.)

Master of Arts (M.A.)
In Anthropology, Canadian Studies, Classics, Comparative Literature, Economics, English, French, Geography, German, History, International Affairs, Philosophy, Political Science, Psychology, Public Administration, Religion, Spanish, Sociology, and Soviet and East European Studies

Master of Engineering (M.Eng.)
In Aeronautical, Civil, Electrical, Mechanical and Materials Engineering

Master of Journalism (M.J.)

Master of Science (M.Sc.)
In Biology, Chemistry, Geology, Mathematics, and Physics

Master of Social Work (M.S.W.)

Doctor of Philosophy (Ph.D.)
In Biology, Chemistry, Economics, Engineering (Aeronautical, Civil, Electrical, and Mechanical), Geology, History, Mathematics, Physics, Political Science, Psychology, and Sociology

Academic Dress

The academic dress of Carleton University is a compromise between the style of hoods outlined in the American Intercollegiate Code and the dress of the ancient foundation of Britain and America.

The Master's hood, made of black silk, is of simple or Oxford shape with an open lining of two chevrons (red and black) on a silver field. The border of the hood denotes the degree granted, according to the following colour combinations: Arts — white; Journalism — white with a black cord sewn slightly in from the lower border; Science — golden yellow; Social Work — cream; Engineering — orange. The Master's gown is of full style, made of black silk or rayon, with full gathered yoke behind and closed sleeves with an opening at the elbows.

The Doctor of Philosophy hood is also made of silk, but completely opened to show the lining, and provided with a purple border. The doctoral gown has the same style as the Master's and is made of royal blue cloth with facings of a light blue silk.

The gown of the Honorary Doctorate of Laws, of Science, or of Engineering is a blue robe with bell-shaped sleeves, made of fine royal blue cloth with facings and sleeves in light blue silk. The hood is made of the same material as the gown, has the same lining as that for the degrees granted by examination, and is bordered with purple for the degree of Doctor of Laws, dark red for the degree of Doctor of Science, and orange for the degree of Doctor of Engineering.

Academic Schedule

The following schedule of dates is anticipated for academic activities and procedures; however, it is subject to final confirmation by the University Senate.

Spring Term and Summer Session 1976

May 19, 20
Registration for spring term.

May 24
Statutory holiday, University closed.

May 25
Spring term classes begin.

June 4
Last day for late registration for spring term. Last day for spring term course changes.

June 6
Spring Convocation for the conferring of degrees.

July 1
Statutory holiday, University closed.

July 2
Registration for summer session day division.

July 5
Summer session day classes begin.

July 12
Last day for late registration for summer session. Last day for summer session course changes.

August 2
Civic holiday, University closed.

August 13
Last day for spring term and summer session classes. Last day for withdrawal from spring term and summer session courses.

August 16, 18
Spring term and summer session examinations.

Fall Term 1976

June 2
Last day for the receipt of applications for fall term registration from candidates whose documents originate outside Canada. Supporting documents (transcripts, letters of reference, etc.) must be received by June 30. Applications from candidates in this category who intend to register initially for the winter term must be received by October 1, and for the spring term by February 1.

August 16
Last day for receipt of applications for fall term registration from candidates resident in Canada. Supporting documents (transcripts, letters of reference, etc.) must be received by September 1. Applications from candidates resident in Canada who intend to register initially for the winter term must be received by November 1; and for the spring term by April 1.

September 1
Last day for receiving applications for degrees from potential graduates for Fall Convocation.

September 3
Last day for submission to the thesis supervisor of four examination copies of the Ph.D. thesis for Fall Convocation and four examination copies of the Master's thesis for Fall Convocation.

September 6
Statutory holiday, University closed.

September 7-10
Registration of graduate students for the fall and winter terms.

September 13
Classes begin in all courses.

October 1
Last day for late registration for fall term. Last day for course changes for full courses and fall term half-courses. Last day for submission to the Graduate Studies Office of four final copies of Master's and Ph.D. theses for Fall convocation.

October 11
Statutory holiday, University closed.

November 12
Fall Convocation for the conferring of degrees.

December 10
Last day for fall term classes. Last day for withdrawal from fall term half-courses.

December 11-21
Mid-year examinations, including half-course finals, may be scheduled as announced.

December 25
Statutory holiday, University closed.

Winter Term 1977

January 1
Statutory holiday, University closed.

January 3
Registration for winter term; winter term classes begin.

January 21
Last day for course changes for winter term half-courses. Last day for late registration for winter term.

March 1
Last day for receiving applications for degrees from potential graduates for Spring Convocation.

February 21-25
Study period.

March 3
Last day for receipt of applications for admission from candidates who wish to be considered for the initial award (April 1) of financial assistance (including Carleton fellowships, scholarships and departmental assistantships) administered by Carleton University. Supporting documents (transcripts, letters of reference, etc.) must be received by March 14. Candidates whose applications are received after the March 3 deadline date may be eligible for the award of a fellowship, scholarship or assistantship by reversion. Awards by reversion are normally considered on or about May 15, August 15 and October 1.

April 1
Last day for submission to the thesis supervisor of four examination copies of the Ph.D. thesis for Spring Convocation. (See also May 19)

April 8
Last day of winter term classes. Last day for withdrawal from full courses and winter term half-courses.

April 8-10
Easter weekend, University closed.

April 13-May 3
Final examinations may be scheduled as announced.

April 15
Last day for submission to the thesis supervisor of four examination copies of the Master's thesis for Spring Convocation. (See also May 19)

May 19
Last day for submission to the Graduate Studies Office of four final copies of Master's and Ph.D. theses for 1977 Spring Convocation.

1976

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Graduate Diplomas and Degrees Awarded

	D.P.A.	M.A.	M.Sc.	M.Eng.	M.S.W.	Ph.D.
1954	3					
1955	3	1				
1956	4	3				
1957	1	2				
1958	3	3	1			
1959	10	3	—			
1960	8	2	—			
1961	11	11	2			1
1962	4	13	7			—
1963	15	6	7	1		—
1964	9	19	5	2		1
1965	26	32	8	16		2
1966	18	59	13	15		5
1967	26	55	14	21		2
1968	28	88	21	22	34	12
1969	26	117	23	18	38	14
1970	34	142	32	29	44	10
1971	46	137	36	27	41	17
1972	34	193	29	41	47	19
1973	26	154	32	31	54	28
1974	20	164	18	30	51	17
1975	19	145	27	25	54	22
Total	374	1349	275	278	363	150

Admission Requirements

Graduates of recognized universities, with at least second-class standing, will be considered for admission to the Faculty of Graduate Studies and Research. The University's general policy on admission is outlined below, but all applicants should refer to the departmental statements in this Calendar for details concerning the specific or additional requirements of each department, institute, or school.

A combination of factors is taken into consideration in assessing the eligibility of a candidate for admission into one of the graduate programs:

- the performance of the candidate and the assessment provided by his/her referees as a measure of the likelihood that the candidate can successfully complete the course of studies and research defined by the Senate of the University for the given degree;
- the capacity of the graduate department, school or institute to provide a program of studies and research which would meet the expectations of the candidate as defined in his/her statement of academic interests and ambitions;
- the availability of a faculty member competent to supervise the academic program of studies and research of the candidate at the time.

Qualifying Year Program

Applicants who do not qualify for direct admission to the Master's program may be admitted to a Qualifying Year program. Applicants having undergraduate degrees which are comparable to a pass degree from Carleton University (rather than an Honours degree) will normally be admitted to a Qualifying Year Program.

If successful in this Qualifying Year, they may eventually proceed to the Master's program. However, admission to the Qualifying Year program does not imply automatic admission to the Master's program. At the end of the Qualifying Year program, the department will determine the student's eligibility to enter the Master's program, and the student will be informed of this decision by the Dean of the Faculty of Graduate Studies and Research.

Applicants for a Master's degree who have a program requirement of eight full courses or more (with the exception of Social Work and Public Administration) will register initially in the Qualifying Year program.

Master's Program

An Honours bachelor's degree (or the equivalent) with at least second-class standing is required for admission to the Master's program. The applicant must also be recommended by the department in which he plans to undertake his studies.

Applicants for a Master's degree who have a program requirement of seven full courses or less will register directly in the Master's program.

Doctoral Program

A Master's degree, with at least high second-class standing from a recognized university, is ordinarily required for admission into the Ph.D. program.

Applicants should note that of the B.A., M.A., and Ph.D. degrees, only two may ordinarily be taken at Carleton University.

Application for Admission

Applications for admission to the Faculty of Graduate Studies and Research should be made on prescribed forms available from the major department or the Graduate Studies and Research Office and submitted directly to the department.

Deadlines

Candidates whose documents originate outside Canada must apply by June 1. All other applications must be received no later than August 15.

Applicants wishing to be considered for the award of a fellowship, scholarship or assistantship administered by Carleton University are reminded that they must submit their applications for admission by March 1 and that the

supporting documents, (for example, transcripts and letters of reference) must be received by March 15.

Transcripts

Two detailed *official* transcripts of the applicant's entire university record must be sent to the chairman of the department concerned.

Letters of Reference

All applications must be supported by letters of recommendation from at least two faculty members with whom the candidate has studied and who are in a position to assess his potential for graduate studies and research. References from non-academic supervisors are not ordinarily acceptable, except in certain cases, such as that of a part-time student working in a research laboratory environment. These letters are to be sent by the referees directly to the chairman of the department.

Proficiency in English

Proficiency in English usage is considered necessary to pursue graduate studies at Carleton. Departments may request that applicants whose native tongue is not English be tested for proficiency in the English language. In such cases, the applicant will be advised to write to:

English Language Institute
Testing and Certification Division
The University of Michigan
North University Building
Ann Arbor, Michican 48104
U.S.A.

The cost of this language test is $15. The Carleton Faculty of Graduate Studies and Research will secure the results directly from the Testing Institute.

Admission Procedures

All applications for admission will be initially examined and evaluated by the department, institute, or school in which the applicant wishes to study. All supporting documents (transcripts, letters of reference, etc.) must be received before any application can receive formal consideration.

Completed applications of those students whom the department wishes to recommend for admission will be forwarded to the Dean of the Faculty of Graduate Studies and Research for consideration and approval. The office of the Dean will officially notify each applicant whose admission is approved.

The Statement of Standing on Admission issued to each newly admitted applicant is valid only for the 12-month period stipulated on the form. If the applicant fails to register within this period of time, his admission and registration eligibility will lapse automatically. He may re-apply for admission.

Program Requirements

As part of the learning experience at Carleton, all graduate students are expected to take an active part in the teaching and/or research activities of the unit in which they are registered; that is, either by serving as an assistant or by undertaking independent research work related to the research effort of the department under the direction of his/her supervisor.

A description of each program offered under the auspices of the Faculty of Graduate Studies and Research is presented in the departmental program descriptions and details of courses section of this Calendar. Prospective applicants should note particularly the admission requirements, the field in which advanced study and research may be undertaken and the program requirements of each department in addition to the general regulations of the Faculty of Graduate Studies and Research spelled out in this section.

Qualifying Year Program

Students in the Qualifying Year will ordinarily register in five full courses (or the equivalent) at the senior undergraduate level. Of these five, no more than one course at the 200 level and no more than two at the 500 level may be taken.

Master's Program

The normal requirement for the Master's degree is five full courses, or the equivalent, of

which at least three (including the thesis where applicable) must be at the 500 level. With departmental approval, the remaining two courses may be selected from those offered at the senior undergraduate level.

Doctoral Program

The period of formal study and research required in the Ph.D. program will be at least two years of full-time study (or the equivalent) beyond the Master's degree.

The thesis will ordinarily carry a weight of about half of the total requirement of ten full courses or the equivalent.

Ordinarily, all courses taken for credit towards the Ph.D. degree must be at the 500 or 600 level.

Transfer of Credit

Graduate courses completed at another institution may be accepted in partial fulfillment of Carleton's degree requirements. Credit for such work will be determined by the Executive Committee of Graduate Studies and Research on the recommendation of the department concerned.

Full-time Master's candidates are allowed a maximum of two transferred full course credits; part-time students are permitted only one such course. If a Master's candidate is granted transfer credit for two full courses, his remaining three courses at Carleton must be at the 500 level.

Doctoral candidates may be given up to one year's credit for work completed at other universities, but must normally register for a minimum of one year of full-time studies thereafter at Carleton, during which time the thesis and comprehensive examination will be undertaken. Students admitted with transfer of credits in a Ph.D. program may be required to pass a qualifying examination upon entry.

Course work completed as a Special student at Carleton is not normally acceptable for degree credit in the Faculty of Graduate Studies and Research. In exceptional cases, transfer of credit may be permitted for a maximum of two such courses provided that the student has obtained high standing. The total number of transferable credits (that is, credits from another university and/or credits earned as a Special student at Carleton) is limited to two full courses or the equivalent.

A student formally admitted, and eligible to register in the graduate program, is not normally permitted to register at the same time in any other degree program or as an Undergraduate or Special student. Should he do so, credits may not be transferred. (see page 16)

Similarly, if a student, formally admitted to Carleton (but not yet registered), wishes to enroll in courses at another university, credit will be granted only if written permission is received from the Dean of Graduate Studies and Research that the courses may be taken for credit. Such permission must be received in advance of registration for the course work.

In all cases, however, work counted for credit must fall within the time limitation for graduate study (see Time Limit), and any transfer credit must be established at the time of admission or initial registration.

Language Requirements

Some graduate programs require a reading knowledge of one or more languages other than English. Language requirements will be prescribed by the departments according to departmental regulations and the needs of their students.

Registration and Course Selection

The Faculty of Graduate Studies and Research divides the calendar year into three terms, and the Academic Year (September-May) into two terms. Each term comprises about 13 weeks of lectures or seminars. The first term of the Academic Year is designated as the *fall term* (registration period at the beginning of September). The second term of the Academic Year is designated as the *winter term* (registration period early in January). The third term of the calendar year is designated as the *spring term* (registration period late May). Some graduate and senior undergraduate courses are also offered in the *summer session* (registration period early in July) which comprises approximately six weeks of lectures or seminars. The precise dates of registration for the fall, winter

and spring terms and for the summer session are specified in the Academic Schedule of this Calendar.

All students enrolling at Carleton are required to register in their programs at designated times prior to the beginning of classes.

All graduate students initiate their registration procedures in their major department from whom information concerning all phases of registration will be available.

Graduate students must have *written approval* from their departmental supervisor of graduate studies for initial course/program registration and for any subsequent course changes. This approval is also required for any undergraduate student who wishes to register in a graduate level course.

The onus to establish that a student is properly registered in a course rests with the student himself who should be governed by regulations in this Calendar.

Credit will be granted only for those courses and research activities for which the candidate is formally registered. An unregistered student is not entitled to attend lectures, tutorials, or seminars and is not entitled to thesis supervision, examination privileges or access to research facilities. A student will receive no credit for any work completed during a term in which he was not properly registered.

Course Selection

A student proceeding to a graduate degree or diploma must arrange his program according to the regulations of the Faculty of Graduate Studies and Research and the major department, and must have his selection of courses approved by the department during registration.

The course and thesis requirements of each graduate program are organized or defined in units of full course credits. A full course credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent. A half-course credit typically comprises three hours of lectures or seminars a week for one term, or the equivalent.

Status

A full-time graduate student will normally register in a minimum of three half-courses (or the equivalent) per term.

Part-time students are permitted to enroll in a maximum of two half-courses per term.

All students are reminded that status is established only by formal registration in the appropriate subjects or courses for each term of activity in the calendar year. See also Continuous Registration.

Definition of Full-time Study

In addition to the *course load* requirements described above, the following criteria for full-time status have been established by the Ontario Ministry of Colleges and Universities:

- The student must identify himself as a full-time student. That is, he must so register during each term of activity.
- The student must be geographically available and visit the campus regularly; he may not be absent from campus without permission for a period exceeding four weeks in any term. Students wishing to undertake full-time studies off-campus must secure, in advance, the written permission of the departmental chairman and the Dean of Graduate Studies and Research (see Off-campus Research).
- A full-time graduate student may not be regularly employed on other work (or by the university) for more than an average of ten hours per week during any period of full-time registration. If the student is employed as a teaching or research assistant or laboratory demonstrator, the ten hours per week should represent the total time devoted to these duties; that is, it includes time spent on preparatory work, marking, etc.

Off-campus Research

In special cases it may be possible for a *registered full-time* graduate student to arrange to undertake full-time studies or research at another institution or in the field. It should be understood that such activity would apply only to a part of the total program and the off-campus period would not normally exceed 12 months.

Requests for special permission to undertake full-time off-campus study or research must be submitted, well in advance, to the Dean of Graduate Studies and Research, through the department concerned. Such requests should

include the following information:

- a detailed statement of the research proposal and of the specific arrangements that are proposed for the supervision and direction of the work;
- an explanation of the reasons why the work cannot be satisfactorily undertaken while on-campus at Carleton;
- a description of the laboratory and/or research facilities that are available at the proposed off-campus location;
- a written statement from a responsible official (for example, the on-site supervisor or director) of the outside institution confirming that the proposed arrangements are satisfactory and that the candidate will be able to undertake research or studies;
- a time-schedule for the proposed research work;
- a statement of the candidate's expected sources of financial support.

University of Ottawa

Through a reciprocal agreement, a full-time graduate student registered at Carleton University may be permitted to follow up to two full courses at the University of Ottawa. Moreover, there are reciprocal arrangements worked out between departments/institutes/schools at both universities to involve students, when it is desirable, in parts of the program of research and studies at the other institution. All interested students should consult the chairman of their department, institute or school prior to registration in order to obtain further information on particular departmental conditions of eligibility and procedures.

Inter-university Cooperation in Graduate Instruction

Under certain circumstances it is permissible for a student admitted to a graduate degree program and registered at one Ontario university to follow approved credit courses at another university. All interested students should consult the chairman of their department, prior to registration in order to obtain further information on conditions of eligibility and procedures.

Continuous Registration

Any candidate (full-time or part-time), after initial registration in a thesis or research essay, must maintain this registration in all successive terms until his thesis or research essay is completed.

Students who have valid reasons for not registering for a term may apply for permission to remain unregistered by:

- writing to the Dean of Graduate Studies and Research, stating the reasons for an exemption; and
- requesting a statement from their thesis supervisors and departmental supervisors of graduate studies that they will not be on-campus for four months, will receive no supervision, and will not use any university facilities (i.e. library, laboratories, computer centre, or receive any type of supervision, including supervision through correspondence, etc.) The statement, to be sent to the Dean, must confirm that thesis work of any kind will not be pursued during the term in question.

Exemptions are normally granted for one term, but in extraordinary circumstances for a longer period.

Audit Courses

Graduate students may register to attend courses without receiving credit. Full-time students may register to audit *one course per program* without an additional fee; all others must pay the regular course fee.

Tutorials

These are arranged to allow the students to take full advantage of all the resources of the university, even in areas or fields of a more highly specialized nature. Such arrangements are subject to the approval of the Supervisor of Graduate Studies who will arrange that a document spelling out the details of the topic, reading list, etc. is submitted to the Faculty of Graduate Studies and Research before the last day for course changes in the term concerned.

Thesis and Research Essay Registration

After initial registration in a thesis (599 or 699) or research essay (598), a student must maintain registration until it is completed.

Registration is required in subsequent terms, including the term in which the student expects to complete and/or be examined in the thesis or research essay. Completion means modifications, any retyping involved, etc. of the four final copies of the thesis or research essay for deposition in the Graduate Studies and Research Office. (See Continuous Registration.)

Whether a student registers on a full- or part-time basis is determined by the amount of time devoted to graduate studies and research, the demands on university personnel, resources and facilities.

Registration by mail is acceptable for part-time students provided that the prescribed form is completed and returned (through the department concerned) together with fee payment (cheque or money order) before the last date for course changes in each term.

The per-term fee for part-time registration is equivalent to the prevailing fee assessment for a half-course. Details of fees for students completing theses and research essays on a full-time basis can be found on page 26.

Thesis Registration Assessment of Part-time Students

Students who elect to complete their theses on a part-time basis will be assessed prorated fees that reflect the credit weight of their theses. In other words, a student enrolled in a doctoral thesis, worth six credits, will be assessed a fee equivalent to one full course *per term* for the first six terms in which he registers in the thesis as a part-time student. Thereafter, the fee for registration is equivalent to the prevailing fee assessment for a half-course.

Dual Registration

A student who proposes to study in two programs at Carleton University concurrently, one or both of which are graduate programs, must obtain special permission, renewable each term, from the Dean of Graduate Studies and Research and chairmen of the departments concerned. A student who is permitted dual registration must file separate registration forms for each program, and may be full-time in only one of them.

Off-campus Registration

Students who have been permitted to study off-campus, while registered full-time at Carleton, or who are registering in theses or research essays may register by mail. Registration forms may be obtained from the Graduate Studies Office upon written request.

Course Changes

A course change is the addition or deletion of one or more individual courses by a registered graduate student. A course change is the only acceptable procedure for revising or correcting a graduate student's registration. All course changes must be made on prescribed Course Change Forms available at the departmental offices or the Graduate Studies Office.

A part-time student who is registered in two courses and drops one of these may be entitled to a *pro rata* fee credit or refund, depending on the length of time elapsed since the beginning of the term.

The deadline dates for course changes are stipulated in the Academic Schedule of this Calendar.

Withdrawal

A graduate student wishing to terminate his registration in a graduate program (that is, drop all courses) must complete the prescribed Withdrawal Form (or apply in writing to the Dean of Graduate Studies and Research) and return his identity card.

When a student officially withdraws with the approval of the Dean of Graduate Studies and Research, a refund of fees will be calculated on a *pro rata* basis as of the date of receipt of the Withdrawal Form (or letter) and the identity card. Credit for fees or refunds will depend on the date of withdrawal, the amount of fees paid, and the length of time elapsed since the beginning of the term.

Graduate students are cautioned that there is no procedure at Carleton University for direct "mid-term" transfer from one graduate program to another. Similarly, there can be no direct transfer to or from undergraduate or Special student status. Any candidate who elects to change programs after registration (and before the last date of late registration)

may be required to withdraw from the first program and then register in the second. The *pro rata* refund of fees calculated as a result of withdrawal from the first program can be applied against the new fee assessment for the second program.

A registered candidate who completes his degree or diploma requirements prior to the last day for withdrawal in any term (as specified in the Academic Schedule) is required to withdraw formally if he anticipates any refund of fees. A candidate whose degree program has been completed is not eligible for further registration in the Faculty of Graduate Studies and Research (unless he has been admitted to some other graduate program).

Examinations

Final examinations in courses will be held at the times indicated in the Academic Schedule. Graduate students must obtain grades that meet the standards outlined in the Academic Standing section of this Calendar, and that satisfy the specific requirements of the department concerned.

Special Examinations

A graduate student who is unable to write a final examination because of illness or other circumstances beyond his control, or whose performance on the examination has been impaired by such circumstances, may apply to write a special or deferred final examination.

Such an application will be considered only if it is submitted in writing to the Dean of Graduate Studies and Research within two weeks of the examination, and if it is fully supported, in the case of illness, by a medical certificate, or in other cases, by appropriate documents.

Supplemental or other grade-raising examinations are not permitted for students registered in the Faculty of Graduate Studies and Research. Graduate students may, however, repeat a course at the time of the next regular offering to obtain higher standing.

Oral and Comprehensive Examinations

The chairman of the department is responsible for announcing (at least two weeks in advance) the date, place, and time of a comprehensive examination. He will also appoint an examining board according to guidelines laid down by the Faculty of Graduate Studies and Research.

If a comprehensive examination is graded *Unsatisfactory*, the department may permit the candidate to repeat the examination. If the examination is graded *Unsatisfactory* for a second time, a request by the department that the candidate be allowed to continue in the program would require the approval of the Executive Committee of Graduate Studies.

Master's Examinations

In addition to any examination which may be required in individual courses, a Master's candidate who is writing a thesis will be expected to undertake either an oral defence of the thesis or a comprehensive examination in his field of specialization, or both. The thesis must be submitted, in examinable form, at least two weeks in advance of the thesis examination. When the degree is taken by course work, a comprehensive examination may be required. It is important to note that individual departments may have additional or particular requirements.

Doctoral Examinations

Doctoral candidates may be asked to pass a qualifying examination at the beginning of their residence at Carleton.

A comprehensive examination covering prescribed fields will normally be undertaken one year prior to the thesis presentation. This examination (oral or written, or both) may include any material considered fundamental to a proper comprehension of the field of study.

After the thesis has been received and approved, a final oral examination on the subject of the thesis and related fields will be held. Such thesis examinations will be scheduled upon receipt of theses, which must be submitted at least four weeks in advance of the date of the examination.

Grading System

Carleton University employs the 12-point system of letter grades to represent standing in graduate lecture courses, directed studies, seminars, tutorials and some research essays and theses. The letter grades used, and the grade point equivalents, are as follows:

A +	12	B +	9
A	11	B	8
A–	10	B –	7
C+	6	D +	3
C	5	D	2
C –	4	D –	1

Under certain defined circumstances, notations are used instead of letter grades to represent standing. The only notations permissible in the Faculty of Graduate Studies and Research are the following:

- Comprehensive examinations are graded *Pass With Distinction*, *Satisfactory*, *or Unsatisfactory*.
- The Master's thesis is graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*, or it may be assigned a letter grade. The oral defence is graded *Satisfactory* or *Unsatisfactory*.
- The doctoral thesis and its oral defence are each graded *Satisfactory* or *Unsatisfactory*.
- A notation of *Incomplete* may, subject to the approval of the chairman of the department, be assigned to a course in which the student has been granted the privilege of submitting an assignment after the final deadline date. This notation of *Incomplete* will be permissible only in exceptional cases, (for example, medical or other special reasons) and must be replaced with a letter grade within 30 days of the end of classes. If the notation of *Incomplete* is not changed to a letter grade (through the regular change of grade procedures) within 30 days of the end of classes, the notation will remain as a permanent entry for that registration in the course. However, the student may register to repeat the course in order to obtain letter grade credit in the subject.
- A notation of *Absent* will be assigned to any course in which the student failed to attend the final examination. If the student explains his absence (in writing) to the Dean of Graduate Studies and Research within 14 days of that examination, he may be granted the privilege of undertaking a special or deferred examination. The notation of *Absent* will also be assigned where a student has terminated a course without formally withdrawing from the course prior to the end of classes.
- If a thesis or research essay is not completed by the end of the period of registration, a notation of *In Progress* will be recorded. This notation must be replaced by an appropriate final notation or grade (as specified above) after the thesis or research essay has been examined. In cases where a student has registered in a research essay or a thesis, without completing it, and later undertakes course work to complete the degree program — or loses graduate student status in his program — the notation *In Progress* will be changed to *Incomplete*.

Academic Standing

Qualifying Year

The general regulations governing academic standing in the Qualifying Year conform to those of the Master's program.

Master's Program

A grade of B– or better must normally be obtained in each course counted towards the Master's degree. A candidate may, with the recommendation of his department, be allowed a grade of C+ or C (but not C–) in one full course or each of two half-courses.

Full-time Master's candidates who fail to achieve a weighted grade point average of 6.5 after two terms of study will be required to withdraw from the program. In the event of special or extenuating circumstances, the student may apply to the Executive Committee of Graduate Studies and Research for permission to continue in the program.

A part-time Master's student who fails to achieve or maintain a weighted grade point average of 6.5 after completing two full courses (or equivalent) will be required to withdraw from the program.

Doctoral Program

Doctoral students must normally obtain a grade of B– or better in each course counted towards the degree.

Thesis Requirements

General Remarks

The thesis is a major requirement of most programs and, in conjunction with the research for it, makes up at least one-half of the time normally required for the program. The thesis must be expressed in a satisfactory literary form consistent with the discipline concerned and must display a scholarly approach to the subject and thorough knowledge of it. A critical review of previous work related to the subject should usually be given.

Master's Thesis

The Master's thesis should embody the results of successful scholarly research in a specialized area. It should exhibit the candidate's knowledge of recognized techniques of investigation and critical evaluation, and be presented in an organized and systematic way.

Departments may undertake periodic evaluations of a student's progress in his or her thesis or research essay, to determine whether the student's progress is satisfactory.

Candidates are ordinarily required to undertake an oral examination on the thesis. Notice of this examination will be given at least two weeks in advance by the chairman of the department.

The Master's thesis will be examined by a board consisting of at least three members, including the thesis supervisor, the chairman of the department concerned, and an examiner from a department other than that of the candidate.

The constitution of the examining board will be announced by the chairman of the department concerned.

Thesis weight (one to two full courses) must be identified at the time of initial registration. A change in the thesis weight at a later date would require the approval of the Executive Committee of Graduate Studies and Research.

Doctoral Thesis

The doctoral dissertation must report, in an organized and scholarly fashion, the results of original research. The thesis must be a contribution to knowledge, and must demonstrate the candidate's ability to undertake sustained research and to present his findings in an appropriate manner.

Departments may undertake periodic evaluations of a student's progress in his or her thesis, to determine whether the student's progress is satisfactory.

The dissertation must be successfully defended at an oral examination. Notice of this examination will be given at least two weeks in advance by the Dean of the Faculty of Graduate Studies and Research.

The Ph.D. dissertation will be examined by a board consisting of at least five members, including the thesis supervisor, the chairman of the department concerned, an examiner from a department other than that of the candidate, the members of the candidate's advisory committee, the Dean of the Faculty of Graduate Studies and Research or his delegate, and an external examiner who is a recognized authority in the subject of the thesis.

The constitution of the examining board will be announced by the Dean of the Faculty of Graduate Studies and Research.

Thesis weight (ordinarily about half of the total Ph.D. program requirement of ten full courses) must be identified at the time of initial registration. A change in the thesis weight at a later date would require the approval of the Executive Committee of Graduate Studies and Research.

Advisory Committees

The work of each doctoral candidate will be assisted by an advisory committee of faculty members who will aid him in his preparation for the final comprehensive examination and assist in the evaluation of the thesis and oral examinations.

Deadlines

A Master's student expecting to graduate at the Spring Convocation must submit his thesis or dissertation, in examinable form, to his supervisor by *April 19*. A Master's student expecting

to graduate at the Fall Convocation must submit his thesis by *September 15*.

A Ph.D. student expecting to graduate at the Spring Convocation must submit his thesis or dissertation, in examinable form, to his supervisor by *April 1*. A Ph.D. student expecting to graduate at the Fall Convocation must submit his thesis by *September 4*.

Specifications

The candidate must submit *four* typewritten copies (original and three carbons or acceptable duplicated copies) and must comply with special departmental requirements governing the form of the thesis, including methods of bibliographical entry, use of diagrams and tables.

Abstracts

Each thesis or dissertation must be accompanied by a suitable abstract. The abstract of a Master's thesis should not exceed 150 words, while the abstract of a doctoral thesis may be up to 600 words in length.

Procedures

Regulations regarding style, pagination, copyright, certification, acceptance, grade and size of paper, abstracts, reproduction, microfilming, binding and constitution of the examining board, will be prescribed by individual departments.

The candidate is expected to notify his supervisor and the chairman of the department (at least two weeks in advance) of the date on which he intends to submit *four* copies of his completed thesis. The thesis examination and defence will be scheduled and announced at least two weeks in advance.

Binding of Theses

The four unbound copies of the approved thesis submitted to the Faculty for binding should be the original and three others and must be presented in order of pagination in separate envelopes.

- The third copy is given to the department.
- The fourth copy is for the candidate.

If, at the time of submitting his thesis, the student elects to protect any rights to immediate commercial publication or to obtain a patent which may arise from his research, he may apply in writing to the Dean of Graduate Studies and Research requesting that the thesis be withheld from deposit in the library:

- for an initial period of three months without reason;
- for each additional period of six months, with reason (total period of restriction not to exceed two years).

The student must submit any request for extension of the restriction one month prior to the termination of the previous period. The student and his supervisor will be required to justify the extension of the restriction. Subsequent requests for extension must follow the same procedure.

Time Limits

Master's Programs

Full-time

A full-time Master's candidate must complete his degree requirements within six terms of registered full-time study and within an elapsed period of three calendar years after the date of initial registration.

Part-time

A part-time Master's candidate must complete his degree requirements within an elapsed period of six calendar years after the date of initial registration.

Combined Full-time and Part-time

A Master's candidate who elects to complete his program by a combination of full-time and part-time study is governed by the following elapsed-time limitation: five calendar years if the candidate is registered as a full-time student for two or three terms and part-time for the balance; four calendar years if the candidate is registered four or five terms as a full-time student and part-time for the balance.

Doctoral Programs

Full-time

A full-time Ph.D. candidate who is admitted on the basis of a Master's degree (that is, with a program of ten full courses or the equivalent)

must complete the Ph.D. degree requirements within 12 terms of registered full-time study and within an elapsed period of six calendar years after the date of initial Ph.D. registration.

Part-time
A Ph.D. candidate who undertakes the program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years beyond the Master's level.

Extension of Time Limit

In exceptional cases, an extension of time (one or two terms) may be granted to a candidate whose recent progress (as judged by the department) has been otherwise satisfactory. Requests for extension of time should be directed to the Dean of Graduate Studies and Research through the department concerned.

Appeals

Academic Appeals

Within two weeks of the release of grades or the announcement of comprehensive examination results or thesis results, a graduate student may request, through the Dean of the Faculty of Graduate Studies and Research, that one or more of his grades or results be reviewed.

A graduate student also has the right to appeal decisions made concerning his graduate status or any other ruling related to his program of studies.

All such appeals are to be made in writing, with an explanation of the pertinent circumstances, to the Dean of the Faculty of Graduate Studies and Research. The appeal and the reply of the department concerned will be subsequently considered by the Executive Committee of Graduate Studies and Research.

Other Appeals

Appeals concerning matters of a non-academic nature should initially be directed to the Grievance Committee of the Graduate Students' Association.

If the problem is not resolved by this committee, in consultation with the administrative unit concerned, the matter will then be referred to the Dean of the Faculty of Graduate Studies and Research for consideration by the joint Grievance Committee of the Faculty of Graduate Studies and Research and of the Graduate Students' Association.

Graduation

On the recommendation of the Faculty of Graduate Studies and Research and with the approval of the Senate of the University degrees are conferred by the Chancellor. Convocations for the conferring of degrees are ordinarily held in the spring and fall of each yeear.

Students expecting to graduate at the Spring Convocation must apply for graduation in the Graduate Studies Office by *March 1.* Those expecting to graduate at the Fall Convocation must apply by *September 1.*

General Information

Hours of Operation

Bookstore

Labour Day to May (end of examinations)
Monday to Friday 9 a.m.—4:30 p.m.; 7—9 p.m.

At all other times hours vary and are posted at the entrance.

Business Office

Labour Day to April 30
Monday to Friday 9 a.m.—5 p.m.
Monday to Thursday 7—9 p.m.

May 1 to Labour Day
Monday to Friday 8:30 a.m.—4:30 p.m.
Mondays and Thursdays only 6:30—8:30 p.m.

Library

Evening Summer Session (May-June)
Monday to Thursday 8:30 a.m.—10 p.m.
(10—11 p.m. study facilities only)
Friday 8:30 a.m.—5 p.m.
Saturday 12:30—4:45 p.m. (9:45 a.m.—5 p.m. study facilities only)
Sunday closed

Day Summer Session (July-August)
Monday to Thursday 8:30 a.m.—10 p.m.
(10—11 p.m. study facilities only)
Friday 8:30 a.m.—5 p.m.
Saturday 9:45 a.m.—4:45 p.m. (4:45 p.m.—5 p.m. study facilities only)
Sunday (1—6 p.m. study facilities only)

Winter Session (September-May)
Monday to Thursday 8:30 a.m.—10 p.m.
(10—11 p.m. study facilities only)
Saturday 10:00 a.m.—4:45 p.m.
(4:45 p.m.—10:00 p.m. study facilities only)
Sunday hours vary with demand.

When classes are not in session hours vary and are posted at the entrance.

Library Regulations

All persons registered at the University are entitled to use the Library on a year-round basis. Graduate students may borrow most books for a period of up to four weeks, although some books are placed on "Reserve" and may only be borrowed for one week, or on an overnight basis. Alumni of Carleton University, on payment of the appropriate fee, and graduates and students of other universities, on payment of the appropriate fee, and at the discretion of the University Librarian, may have limited borrowing privileges. The University participates in Ontario Inter-University borrowing arrangements which allow students in good standing to borrow directly from other Ontario universities.

If books are not returned to the Library when due, fines and billing costs will be charged.

The book collection is protected from theft by an electronic detection system, and as a condition of use of the Library facilities all users must submit books, briefcases, bags, etc. for inspection at the exit, if requested to do so.

Student Participation in Academic Affairs

New University Government (N.U.G.) is a governing system wherein all faculty members and some students are formally involved in the government of the University at the departmental, faculty board and Senate levels.

The first level is election to the faculty and departmental boards through a general election among all the graduate students in the various departments. From here it is theoretically possible to get support from a majority of faculty and get elected to Senate. As this has happened only twice, the Students' Association is investigating the possibility of direct election by students to these bodies.

Student Government

Carleton University Students' Association

All registered students, full- and part-time, are members of the Students' Association. The Students' Association has two main functions — providing services to students and representing their views on a wide range of interests both

internally and externally.

The legislative body for the Students' Association is Students' Council. Elected representatives from each faculty serve for 12 months with the one graduate representative elected by the Graduate Students' Association in October. The Students' Council President, Finance Commissioner and undergraduate representatives are elected in the spring and the rest of the executive is appointed by the President and subject to Council's approval shortly thereafter.

As services for all students, the Students' Association publishes a weekly newspaper, a course evaluation guide, a literary magazine and runs a licensed A.M. carrier-current radio station. It has recently been granted a licence to operate an F.M. station. It also runs a pub six nights a week, a Box Office and an Information Centre, co-op houses, theatre programs and so on. Each year new services are offered depending on the orientation of the current Students' Council.

One major part of the Students' Association is the University Centre. The Centre is run for the whole university community by the Students' Association which employs an Administrative Manager to take care of the day-to-day operations. Policy is set by the Students' Council. The University Centre has a wide range of facilities, including a variety store, music/reading rooms, coffee house, games areas, concert hall, cafeterias, the radio station and newspaper office, dark rooms, Council offices and, of course, the pubs.

Students' interests are represented by the Association's membership in the Ontario Federation of Students and the National Union of Students. On campus the Students' Council each year tackles a number of issues which have ranged from university government to reviewing athletics to the financing of post-secondary education. The Students' Association offices are located in Room 401 of the University Centre and may be reached by phone at 231-4380.

The Graduate Students' Association

The Graduate Students' Association comprises all students registered in a program of graduate studies at the University. Funds derived through a contractual agreement with the Carleton University Students' Association support the activities of the Graduate Association. These include a bi-weekly newsletter, a lounge open from 12 noon until 11 p.m. Monday through Friday, and financial support for departmental activities through a system of departmental grants.

The aim of these programs is to provide opportunities for graduate students to *communicate* with each other, and with the entire university community about issues and problems of particular concern to graduate students.

There are three elective executive positions (president, internal and external vice-presidents) and an elected council consisting of representatives from each graduate department. In addition, there is one graduate representative on the Students' Council. Elections generally take place in the fall term, during mid-October.

The current executive welcomes the interest and assistance of all graduate students.

The Alumni Association of Carleton University

The Alumni Association was founded in 1949. Its objectives are to contribute to the development of the University, academically and otherwise, and to the effectiveness with which it fulfills its role in society; to ensure mutually beneficial relations and communications between the University and its alumni, and among the alumni members themselves; and to foster an understanding of the function of the Alumni Association among the students of the University, and the University community generally.

Alumni address records are maintained by the Carleton University Development Office, which is also responsible for all alumni fundraising activities. Alumni communications programs are carried out through the Carleton University Information Office. All other Association activities and programs are supervised by the Alumni Association Board of Directors, which consists of four executive officers and six directors.

The University Centre

The University Centre is a division of CUSA which houses the following facilities: food services, lounges, main hall, meeting-dining rooms, variety store, table tennis and billiards tables, Students' Council offices, Faculty Club, music listening room, reading room, health services, Canada Manpower Office, etc. The Centre is for the use of all members of the University community.

Housing and Food Services

Residences

There are currently five residence houses on the Carleton campus which accommodate a total of 1,317 students in men's, women's and co-educational living arrangements.

Residence accommodation is for full-time Carleton students, graduate and undergraduate. Currently there are no facilities on campus for married students.

The 1975-76 cost of room and meals is $1,450 for a single room and $1,350 for a double room.

For application forms or further information contact the Student Housing Office, Commons Building.

Graduate Student Residence

In addition to the facilities of the campus residences, there are two off-campus houses which are used to accommodate graduate students only. These houses provide accommodation for ten women and 12 men as well as two apartments for married couples.

For application forms or further information contact the Student Housing Office, Commons Building.

Off-campus Housing

An off-campus housing information service is available to assist students who are unable to obtain or do not wish to have on-campus residence accommodation. This service has been established to assist out-of-town students, but is in no way a rental agency.

Listings of available accommodations are posted in the second level corridor of the Commons Building. This area is open seven days per week day and night for your convenience.

Food Services

All students may use the residence dining facilities (University Commons) on an occasional basis or by purchasing a term meal ticket. The Commons also has a snack bar.

Additional dining and cafeteria facilities are located in the University Centre and the Loeb Building.

Athletics and Recreation

The athletics and physical recreation program at Carleton, which plays an important role in maintaining and enhancing the University spirit, is co-ordinated by the Athletic Board, a committee consisting of students, faculty members, and administrators.

At the intercollegiate level Carleton is a member of both the Ontario Universities Athletic Association (for men) and the Ontario Women's Intercollegiate Athletic Association. Varsity programs for men include basketball, football, and fencing. The women's teams participate in basketball, volleyball, and fencing. Graduate students are eligible for intercollegiate athletics, subject to league regulations.

The intramural program includes flag football, cross-country, basketball, broomball, badminton, swimming, curling and hockey. Some of these sports are co-educational although most are played separately by men and women.

Carleton's athletic facilities currently include football and soccer fields, outdoor hockey and skating rinks, a 50-meter swimming pool, fitness centre, and a gymnasium complex which includes such facilities as squash courts, combatives room, gymnastics and multipurpose room, and a gymnasium. These facilities are available for use by Carleton students for organized and recreational sports activities.

Counselling and Health Services

Counselling and Health Services are provided to protect and improve the physical and mental health of the students and of the university community. Its responsibilities are to provide treatment, to consult and advise on matters of health and to ascertain the fitness of students to perform academic work. When the necessary service cannot be provided by the program, the staff will endeavour, through referral, to make available what is required. The nature of the service demands that the confidentiality of records and information be respected and maintained.

The Counselling and Health Services have regular hours and are staffed by physicians, nurses, counsellors, and psychiatrists.

Health Regulations

- Medical insurance is compulsory for all full-time students.
- All Ontario students should be covered by OHIP.
- Students whose home residence is outside Ontario should have coverage under their provincial plan.
- Students from outside Canada should apply for OHIP. This application should be made as early as possible as there is a delay in coverage after application.

Students who object to the above requirements on conscientious grounds must consult the University physician and provide a written statement giving the basis for such objection.

T.B. Control

All full time students require a tuberculin skin test or chest X-ray if tuberculin positive. These are required to be repeated on a yearly basis while attending university.

Placement and Career Counselling

The Placement and Career Counselling Service is provided by the Department of Manpower and Immigration and is located in Room 508, University Centre (telephone 231-2600).

The purpose of the service is two-fold:

- To provide students with readily available access to employment opportunities. To this end the Centre maintains lists of part-time, summer and regular employment opportunities. As well, each year the Centre arranges for a number of employers, both local and national, to recruit on campus. The majority of these recruiting visits are for the purpose of interviewing graduates and prospective graduates for permanent employment. Information concerning this program is posted early in the academic year, as the recruiting season commences the first week of November, usually terminating in late February or early March.
- To provide students with information about and assistance in preparing for entry into the labour market. Individual and group counselling, covering such topics as labour market trends, specific careers, job hunting and resume preparation, is available to students seeking or preparing for employment. Also, the Centre maintains a library of up-to-date literature of interest to these students.

All Placement and Career Counselling information may be obtained by contacting the Centre or referring to the notices posted throughout the University. The University papers and radio stations are additional sources of information from the Centre.

Day Care Centre

The Day Care Centre at Carleton is a Parent Co-operative Centre which operates in two locations on campus, Renfrew House Residence and the Lower Lounge of the Loeb Building.

They are open all year except for statutory and University holidays.

The hours are from 8:00 a.m. to 6:00 p.m., five days a week and the cost is $165 per month. Municipal subsidy is available for families who qualify.

Currently the ages of children are 12 months to three years and children must leave during the month in which they reach three years. Consideration is being given to raising the minimum age requirement and extending it to four years.

Priority is first given to children of students, then to the children of faculty and staff of Carleton. Should there be vacancies, children will be taken whose parents are not affiliated with Carleton.

There usually is a waiting list, so it is advisable to apply some months before a place is actually required.

Fees

Fees at Carleton are calculated on a composite basis to include tuition, the Students' Association and the Graduate Students' Association, Athletics, University Centre, and Health Services fees. The fees for the 1975-76 year are listed below because an approved schedule for the 1976-77 year was not available at the time that the Calendar went to press. It is anticipated that the fee structure will remain basically the same.

Full-time Students

Diploma in Public Administration

Master's Degree Program

* (first year of full-time study)

Tuition	$292.50
Students' Association	10.85
Athletics	15.65
Counselling and Health	5.85
University Centre	6.65
Total composite fee (per term)	$332.50

(second or subsequent year of full-time study)

Tuition	$133.65
Students' Association	10.85
Athletics	16.65
Counselling and Health	5.85
University Centre	6.65
Total composite fee (per term)	$173.65

* First and second year of full-time study for students in Public Administration and Social Work.

Doctoral Program

(first and second year of full-time study)

Tuition	$292.50
Students' Association	10.85
Athletics	16.65
Counselling and Health	5.85
University Centre	6.65
Total composite fee (per term)	$332.50

(third or subsequent year of full-time study)

Tuition	$133.65
Students' Association	10.85
Athletics	16.65
Counselling and Health	5.85
University Centre	6.65
Total composite fee (per term)	$173.65

Qualifying Year

Tuition	$580.00
Students' Association	32.50
Athletics	50.00
Counselling and Health	17.50
University Centre	20.00
Total composite fee (academic year)	$700.00

Part-time Students

Tuition	$113.20
Students' Association	6.50
Athletics	10.00
Counselling and Health	3.00
University Centre	4.00
Total composite fee (per course)	$136.70

Students who require additional time on a *part-time* basis to complete theses or research essays must register for each subsequent term, at a per term fee equivalent to the prevailing fee assessment for a half-course.

Method of Fee Payments

Fees may be paid in accordance with either of the following plans.

1. Payment in full at the time of registration.
2. Payment in two installments:

- At registration, half of the total tuition fee plus all miscellaneous fees (where applicable)

plus a deferred payment fee of $.50 per half-course (four or more courses: $5.00).
- At or before January 15, the remaining half of the total tuition fee.

Scholarships, bursaries, and loans administered by the University will be applied first to fees provided this is not contrary to the terms of the award.

Personal cheques will be accepted for the payment of accounts, but the University reserves the right to cancel this policy if it is abused. A service charge of $5 will be assessed for each cheque returned to the University as non-negotiable for any reason. Students are requested to provide their own cheques when making payments.

A statement of tuition fees paid may be obtained for taxation purposes by applying to the Business Office in February.

Late Registration Fees

Full-time Students
$10 first week after the regular registration period.
$15 second and third weeks after the regular registration period.

Part-time Students
$5 per course after the regular registration period.

Examination Fees

Special Final Examinations Written at Carleton University
$10 per paper.

Examinations Written at a University Centre other than Carleton University (when permitted)
$20 per paper.

Transcript Fees

All students are entitled to two free copies of their official transcript. Additional copies will be issued at a charge of $.1 for the first, $.50 for the second, and $.25 for each further copy (at any one time of ordering).

Deposit — Gowns and Hoods

At each convocation, the University makes available to graduating students the appropriate academic regalia. A $25 deposit is required, which will be refunded when the regalia are returned.

Fee Refund or Credit upon Withdrawal

A graduate student wishing to terminate his registration in a graduate program (that is, drop all courses) must complete the prescribed Withdrawal Form (or apply in writing to the Dean of Graduate Studies and Research) and return his identity card. When a student officially withdraws with the approval of the Dean of Graduate Studies and Research a refund of fees will be calculated on a *pro rata* basis as of the date of receipt of the Withdrawal Form (or letter) and the identity card. Credit for fees or refunds will depend on the date of withdrawal, the amount of fees paid, and the length of time elapsed since the beginning of the term.

A part-time student who is registered in two courses and drops one of these may be entitled to a *pro rata* fee credit or refund, depending on the length of time elapsed since the beginning of the term. All course changes must be made on prescribed Course Change Forms available at the departmental offices or the Graduate Studies Office.

Delinquent Accounts

Students with outstanding accounts (tuition fees, library fines, traffic violation fines, etc.) will not be permitted to register again until these accounts are paid in full.

Awards and Financial Assistance

General Information

Awards Policy

Scholarships and fellowships are awarded on the basis of academic standing and demonstrated potential for advanced study and research. Unless otherwise stated, awards are for one year only (September to August), but application for renewal will automatically be considered in open competition.

Awards are ordinarily offered only to applicants who have been admitted to full-time graduate studies. Students admitted to the Qualifying Year program are not eligible for major scholarships or fellowships.

In order that awards may be equitably distributed, no student may hold more than one major fellowship or scholarship in a given year. A major award is defined broadly as $2,000 or more for the academic year or $3,000 for a calendar year.

Holders of awards must pay regular tuition fees unless otherwise stated.

Full-time graduate students at Carleton are expected to comply with the following procedures:

- Any full-time graduate student who accepts a scholarship or award that is not directly administered by Carleton University must immediately inform, without delay, his departmental chairman and the Dean of Graduate Studies and Research in writing. This requirement applies to any awards or assistance offered by any other agency or institution.
- Any full-time graduate student who accepts part-time employment outside the university is required to inform his departmental chairman and the Dean of Graduate Studies and Research in writing prior to undertaking the work.
- Any full-time graduate student who obtains part-time employment (teaching, research, or service assistantship) in a university department other than his own is required to inform his departmental chairman prior to undertaking the work. This requirement also applies to employment obtained in an administrative department, (for example, Library, Business Office, Registrar's Office, Residence).

Application Deadlines

March 1 is the last date for receipt of applications for admission from candidates who wish to be considered for the initial award, announced April 1, of financial assistance (including fellowships, scholarships and assistantships) administered by Carleton University. Supporting documents (transcripts, letters of reference) must be received by March 15.

Candidates whose applications are received after the March 1 deadline date may be eligible for the award of a fellowship, scholarship or assistantship by reversion, which are normally considered on or about May 15, August 15, and October 1.

Methods of Payment

Fellowships, teaching assistantships, and research assistantships administered by Carleton University will be paid, through the University Payroll Office, on a monthly basis, *with the first installment on October 1.* Scholarships awarded for the academic year (fall and winter terms) are ordinarily paid in two equal installments: October 1 and January 15. Scholarships awarded for the calendar year are ordinarily paid in three equal installments: October 1, January 15 and June 15 and may be picked up in the Business Office in the Administration Building.

Students are urged to note the above payment dates and be prepared to be financially self-sufficient during the month of September.

Other Awards

A number of national and provincial organizations award fellowships and scholarships that are tenable at Carleton University (for example, the Canada Council, the National Research Council, etc.) Some application procedures and regulations concerning fellowships awarded by agencies other than Carleton University are given in the description of each of these awards.

In addition, a large number of foundations, companies, fraternal organizations, and other agencies offer fellowships and scholarships. Prospective graduate students should consult the biennial publication of Statistics Canada entitled *Awards for Graduate Study and Re-*

search which contains information concerning all such awards, their terms, closing dates and methods of application. Students should also consult the publication entitled *Fellowships and Scholarships offered by Private Donors and Foreign Governments for Canadian Students*, obtainable from the Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa K1P 5N1. These publications are also available for reference in the Graduate Studies Office.

Eligibility

In the case of fellowships, grants, scholarships, etc., for which students must make application, it is the individual student's responsibility to establish his eligibility. Should it become known that a student is unqualified for any reason, he must return the funds already received, with the University assuming no responsibility.

Departments recommending students for awards for which the candidate need not apply (Epstein Scholarships, Carleton Fellowships and Graduate Scholarships) must accept full responsibility for the eligibility of their nominees.

Students are urged to consult carefully the brochures and announcements which specify the conditions associated with tenure of individual awards. This information is available in the Graduate Studies Office and in the office of the chairman of the department concerned. An up-to-date listing of awards is published in the weekly Carleton University newspaper, *This Week*. There is also a handbook available to students and faculty which contains a complete listing of all awards available.

Awards Administered by Carleton University

Carleton Fellowships

The Carleton Fellowships, with a value from $700 to $1,000 per term (fall, winter and spring), are awarded annually to outstanding graduate students. The Fellowship may be held in combination with a teaching or research assistantship which students should negotiate with their department. Recipients must be enrolled full-time in each term of the award.

Application is not required. Recipients are chosen annually by the Awards Committee from the list of candidates recommended by each department.

The David and Rachel Epstein Foundation Scholarships

Part of the income from the David and Rachel Epstein Foundation Fund has been designated to provide scholarships for outstanding graduate students at Carleton University.

Established in 1970, the value of the Scholarships is from $2,100 to $2,400 per calendar year and they may be held in combination with a teaching or research assistantship which students should negotiate with their departments.

Application is not required. Recipients are to be chosen from the list of candidates recommended by each department concerned.

Graduate Scholarships

Scholarships of up to $1,500 per year are awarded to graduate students with high standing. Application is not required. Award winners will be selected from the list of nominees recommended by each department.

John Ruptash Memorial Fellowship

This fellowship was established in 1974 by relatives, former students, faculty colleagues and friends as a memorial to the late John Ruptash who was Dean of Engineering and later Dean of Graduate Studies between 1959 and 1973. The fellowship will be awarded annually, beginning in 1975-76, to an outstanding graduate student in the Faculty of Engineering.

The value of the fellowship is $3,000 per calendar year and it may be held in combination with a teaching/research assistantship from the Faculty of Engineering.

Application is not required. The recipient will be chosen by the Awards Committee from candidates recommended by departments in the Faculty of Engineering.

Graduate Teaching Assistantships

A large number of graduate teaching assistantships, ranging in value up to $1,800 for

Qualifying Year and up to $3,000 for Master's and Ph.D. students for a 12-month period of three consecutive terms, are awarded annually in most departments.

Recipients are required to undertake a teaching assignment up to a maximum total of ten hours a week (the total of ten hours includes class contact time, if any, time devoted to preparative work, marking or grading set assignments, etc.). In Science and Engineering, the assignment associated with a teaching assistantship is usually that of a laboratory demonstrator or assistant. In the Humanities and Social Sciences, the assignment associated with a teaching assistantship is usually that of a discussion group leader. In exceptional cases, a teaching assistantship may involve lecture duties.

For information concerning teaching assistantships students are advised to contact the chairman of their department.

Graduate Research Assistantships

A number of graduate research assistantships ranging in value up to $3,000 for the academic year (fall and winter terms), and up to $4,500 for 12 months are awarded annually in most departments in Science and Engineering.

Recipients must accept an assignment as a research assistant under the direction of a professor. In many cases the assignment will be in the same area as a student's thesis research topic.

For further details contact the chairman of the department concerned.

Summer Supplements

A number of graduate assistantships for the four month period from mid-May to mid-September are available in most departments.

For further information students are advised to contact the chairman of their departments.

Paterson Fellowships

From the generous support provided by the Honorable Norman M. Paterson when the School was established in 1966, funds are allocated to support some candidates for the M.A. degree in the Norman Paterson School of International Affairs.

All those with high standing who are admitted to this M.A. program are considered as applicants for these fellowships.

TIME Canada Graduate Scholarship in Journalism

Established in 1974, this scholarship, which carries a value of $1,000, will be granted annually on the basis of academic and professional excellence to a student entering the Master's program in Journalism.

Application is not required. The recipient will be chosen from a list of candidates recommended by the School of Journalism.

Hudson's Bay Graduate Fellowships in Canadian Studies

Two graduate fellowships, valued at $1,500, will be awarded annually by the Hudson's Bay Company to outstanding students entering a Master's degree program in the Institute of Canadian Studies. The sum of $1,200 will be awarded directly to the student and the balance will go to the Institute.

Application is not required. The recipients will be chosen from a list of candidates recommended by the Institute of Canadian Studies.

Fred Barkley Special Bursary

This bursary, in the amount of $500, is awarded annually to a graduate student from a developing country who requires special financial assistance in order to study at Carleton University. The selection of the recipient will be decided by the Dean of Graduate Studies and Research in September each year.

R.O. MacFarlane Memorial Book Award

This award is presented annually to an outstanding student registered in a graduate program in the School of Public Administration at Carleton University. Endowed in 1971 by relatives, friends and graduates of Carleton University, the award is named in honour of the late R. Oliver MacFarlane, first director of the School of Public Administration, 1953-71.

Residence Fellowships

Residence fellowships for men and women, providing free accommodation and meals for one academic year, are available to students of Carleton University.

Applications are invited from graduate and senior undergraduate students with good academic standing.

Application forms may be obtained from: Student Housing and Food Services Office, Carleton University, Ottawa, Ontario K1S 5B7.

Completed applications must be returned to the above address.

Graduate Bursaries

A full-time graduate student who experiences *unexpected* financial need after completion of five weeks from the date of most recent registration may be awarded a bursary of up to $200 for that term (with a maximum of $500 for three consecutive terms). Application forms are available from departments.

Awards Tenable at Carleton University

Canada Council Doctoral Fellowships

The Canada Council offers fellowships ranging in value up to $4,500 for students in the first two years of their program, and up to $5,500 for students who have completed the first two years of their program, for studies and research at the doctoral level in the humanities and the social sciences.

These fellowships are tenable in Canada or elsewhere for a maximum of 12 months, and may be renewed upon application.

Application forms and brochures containing details of the assistance programs available may be obtained from the Graduate Studies Office or from the chairman of the department concerned, or by writing to The Canada Council, 151 Sparks Street, Ottawa, Ontario.

Students currently enrolled at Carleton University must apply on or before December 11. Others must submit applications to The Canada Council by December 15.

Canada Council Special M.A. Scholarships and The Queen's Fellowships

To be eligible for these awards a student must be nominated by a faculty member of a Canadian university and be in his/her final year of an Honours B.A. program or its equivalent or hold an Honours B.A. degree or its equivalent from a Canadian university. Nominees must be Canadian citizens and intend to pursue full-time graduate studies at a Canadian university.

The value of the award is $4,500, plus travel allowance, and it is tenable for 12 months. The Queen's Fellowships also include tuition fees. Nominations must be submitted on a nomination letter provided by the Regional Chairman. The closing date for nominations from faculty members is October 15.

Central Mortgage and Housing Corporation Fellowships in Urban and Regional Affairs

The Central Mortgage and Housing Corporation annually offers fellowships valued at $4,200 (plus fees and an allowance of $750 for each dependent child) for graduate study and research in a broad range of fields involved in understanding and dealing with urban and regional environment. Among the appropriate fields of study are economics, history, philosophy, geography, psychology, sociology, anthropology, local government and administration, ecology, regional science, transportation, law, urban and regional planning, and environmental studies. Programs of study must, of course, be related to urban affairs.

Applicants must be Canadian citizens or have been landed immigrants in Canada for not less than 18 months at the closing date of submission of applications to Central Mortgage and Housing Corporation. Candidates for study at universities outside Canada must be Canadian citizens.

Applications must be submitted by the applicant to the university at which he proposes to study not later than March 1. Officials of that university will appraise the application and forward it to Central Mortgage and Housing Corporation. Applications will not be accepted by the Corporation directly from applicants.

Application forms and additional information may be obtained from the Administrative Officer, Fellowship Committee, Central Mortgage and Housing Corporation, Ottawa, Ontario K1A 0P7.

Commonwealth Scholarships and Fellowships

The Government of Canada, through the Commonwealth Scholarships and Fellowships Committee, annually offers a number of scholarships and fellowships, normally awarded for two years, which cover such expenses as travelling costs, tuition fees, other university fees, and a living allowance, to students of other Commonwealth countries.

Under a plan drawn up at a conference held in Oxford in 1959, these Commonwealth Scholarships and Fellowships are awarded mainly for graduate study, and are tenable in the country making the offer.

Students are advised to consult the Graduate Studies Office for details of the terms of the awards offered by Canada and other countries, or write to: The Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1.

Persons intending to apply for the year 1977-78 are advised to enquire not later than mid-October, approximately one year prior to the date of tenure.

National Research Council Scholarships

National Research Council Scholarships ($5,000 for 13 months) are tenable at Carleton University by students undertaking advanced studies and research in science, engineering, experimental psychology, and physical geography.

Students currently enrolled at Carleton University must apply on or before December 6 on prescribed forms which may be obtained from the Graduate Studies Office or from the chairman of their department. Others must submit applications by December 31.

1967 Science Scholarships

The National Research Council annually offers scholarships valued at $7,000 per year (plus a travel grant) for a maximum of four years.

Nominations (including supporting documents) must be sent to the Graduate Studies Office by December 6.

The awards are tenable only at Canadian universities other than those from which the recipients have graduated. Recipients are not permitted to accept other scholarships or to accept any remuneration for demonstrating or instructing.

Nominations, which must be received by the National Research Council not later than December 31, will be forwarded by the Graduate Studies Office.

Further details of the terms of this award may be obtained from the Graduate Studies Office or from the chairman of the department concerned.

Ontario Graduate Scholarships

The Province of Ontario annually offers 1000 scholarships of $1,250 per term to students in or entering postgraduate programs. Awards will not be made to students taking a Qualifying or "make-up" year. Students in all disciplines are eligible to apply. The award is intended primarily for Canadian citizens who are residents of Ontario, but ten percent of the awards may be given to landed immigrants.

Applications and information may be obtained from the Graduate Studies Office.

The Queen Elizabeth II Ontario Scholarships

The Queen Elizabeth II Ontario Scholarship Fund provides a number of annual awards, valued at $6,000 each, for graduate study and research leading to the Ph.D. degree in the humanities, social sciences, and mathematics.

The scholarships are tenable only at Ontario universities, and preference will be given to candidates who are residents of Ontario.

Further details of the terms of these awards may be obtained from the Graduate Studies Office.

Prescribed application forms are to be completed and submitted to the Dean of the Faculty of Graduate Studies and Research on or before December 1. Nominations made through the Dean will be forwarded to the Selection Committee by December 15.

Sir John A. Macdonald Graduate Fellowship in Canadian History

The Province of Ontario annually offers the Sir John A. Macdonald Graduate Fellowship, valued at $6,000, for full-time graduate studies and research in the field of Canadian history. The fellowship is tenable for three years, only at an Ontario university, and it will be awarded to a Canadian citizen resident in Ontario.

The fellowship is awarded on the basis of the candidate's academic record and other relevant evidence, the minimum academic prerequisite being an Ontario Honours bachelor's degree, or the equivalent.

Application forms and additional information can be obtained from the Graduate Studies Office. The deadline date for submission of completed applications to the Chairman of the Department of History is January 15.

Department of National Defence Scholarships and Fellowships

The Department of National Defence offers annually scholarships valued at $4,500 plus fees, and fellowships valued at $7,000 plus fees, return economy air fare for the Fellow and his immediate family, and a supplementary award of $1,500 for married fellows.

These awards are to support military and strategic studies of interest to Canada, including work on the national and international aspects of security, studies of strategic theory, alliances and the United Nations, and civil-military relations.

Applicants must be Canadian citizens. Candidates for the scholarships must hold an Honours bachelor's degree or its equivalent and candidates for the fellowships must have a Ph.D. degree or equivalent level of knowledge or experience in the field. Both awards are available for one year, with the possibility of renewal.

Application forms and additional information may be obtained from the Director of Awards, Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1. The closing date for receipt of completed applications is March 1.

Transportation Development Agency Fellowships in Transportation

The Transportation Development Agency awards a number of fellowships valued at $4,200 for 12 months plus tuition fees of up to $700, (Master's and Ph.D. levels), for full-time graduate study in any discipline related to transportation.

Applicants must be Canadian citizens or landed immigrants in Canada before January 1. The awards are tenable at any Canadian university but in special circumstances doctoral awards may be approved for tenure outside of Canada. Recipients must enroll in a degree program which includes a thesis requirement.

Application forms may be obtained from the Graduate Studies Office or directly from the Transportation Development Agency. Applications must be submitted to the University by the candidates before December 15. Completed applications, postmarked no later than December 31, will be forwarded to the Transportation Development Agency by the chairman of the department concerned.

The International Nickel Graduate Research Fellowships

The International Nickel Company of Canada, Limited, annually offers fellowships for graduate studies and research at any Canadian university leading to the Master's or Ph.D. degree in one of the following fields: chemistry or physics of metals; geology (including geophysics and geochemistry); metallurgy (physical and extractive); mineral processing; mining.

Each fellowship has a value of $4,500 or $5,500 per academic year ($700 to be at the disposal of the candidate's supervising professor to defray research expenses) for a period not exceeding three years.

Application should be made prior to February 20 through the University department concerned. Nominations will be forwarded by the University to the awarding agency.

For further information write to The Educational Aid Section, The International Nickel Company of Canada, Ltd., P.O. Box 44, Toronto-Dominion Centre, Toronto, Ontario M5K 1E3.

Bell Canada Centennial Fellowships

Bell Canada annually offers fellowships valued at $5,000 per calendar year ($3,500 to the fellow and $1,500 to the university) for graduate study in any field, preferably in a subject area relevant to the scientific, political, social, or economic needs of Canada.

Candidates must be Canadian citizens or must have held landed immigrant status for at least one year prior to the date of application, and must be graduates of a university or college acceptable to the Association of Universities and Colleges of Canada.

The awards are tenable at any Canadian university or college which is a member or affiliate of the Association of Universities and Colleges of Canada.

Students are advised to consult the Graduate Studies Office for further details of the terms of this award or to write to the Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1.

The closing date for receipt of completed applications is March 1.

Gulf Oil Canada Limited Graduate Fellowships

Gulf Oil Canada Limited annually offers nine fellowships, valued at $5,000 ($4,000 payable to the fellow, and $1,000 to be placed at the disposal of the department in which he is registered), for graduate study and research in a field of study related to the petroleum industry.

The fellowships, which may be renewed, are open to Canadian citizens or persons holding landed immigrant status one year prior to application who are graduates of Canadian universities or colleges which are members or affiliates of the Association of Universities and Colleges of Canada. The awards are tenable only at universities in this category.

Application forms and further details may be obtained by writing to The Director of Awards, Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1.

Applications must be submitted by March 1.

Shell Canada Graduate Fellowship in Geology

Shell Canada provides annually a postgraduate fellowship valued at $3,750, ($3,000 to the student and $750 to the department) for graduate study and research. The award may be held for three years with consideration being given to a fourth year if necessary.

The recipient is chosen by the Awards Committee following nomination by the Department of Geology.

Imperial Oil Graduate Research Fellowships

Imperial Oil Limited annually offers six fellowships, up to the value of $4,000 per year for a maximum of three academic years, for study and research leading to the Ph.D. degree in pure and applied sciences, the social sciences, or the humanities.

The fellowships are open to any Canadian citizen who is a graduate, or prospective graduate in the year of competition, of any approved University.

Nomination forms, which must be received by Imperial Oil Limited not later than February 1, are available from the Graduate Studies and Research Office.

I.O.D.E. War Memorial Scholarships

Ten scholarships are offered annually by The Imperial Order Daughters of the Empire for postgraduate study and research in the humanities or social sciences. The awards are valued at $5,000 for study in Britain or another country in the Commonwealth and $3,000 for study in a Canadian university.

Candidates must be Canadian citizens and graduates of recognized colleges or universities.

Additional information and application forms may be obtained by writing to the I.O.D.E., Educational Secretary for the Province of Ontario, 168 Jackson Street West, Hamilton, Ontario. The closing date for applications is November 15.

J.H. Stewart Reid Memorial Fellowship

This Fellowship provides an award of $3,000 for any field of study in a graduate program in any Canadian university. It is open to stu-

dents who are Canadian citizens or who have held landed immigrant status from February 1, 1975 and have been admitted to a Canadian graduate program by the time of award. Applications, due by February 1, may be obtained from The Awards Officer, Canadian Association of University Teachers, 66 Lisgar Street, Ottawa, Ontario K2P 0C1.

Resources for the Future Incorporated

The RFF Inc. offers annual doctoral dissertation fellowships of $4,500 to assist qualified graduate students in completing doctoral dissertation work in the field of natural resources and to stimulate their interest in the application of social science disciplines to problems in the field of natural resources. Candidates must be nominated by the academic department in which they are doctoral candidates. Direct applications are not accepted.

Nominees must have completed all requirements for the doctorate except the dissertation before the beginning of the 1976-77 academic year. Research must relate to natural resources, their products or services, and must involve the social sciences or related fields of study. Nominations must be received by February 1. Consult the Graduate Studies Office for further details or write Resources for the Future, Inc., Fellowship Program, 1755 Massachusetts Ave. N.W., Washington, D.C. 20036.

Canadian Advertising Advisory Board

Doctoral fellowships up to $4,000 are available for any approved research project in the economic and social aspects of advertising. These fellowships are open to any Canadian citizen or anyone residing in Canada working towards a doctoral degree. Candidates are expected to be at or near the dissertation stage. Applications, due before March 31, should be made directly to Director of Awards, Canadian Advertising Advisory Board, 159 Bay Street, Toronto 116, Ontario.

Canadian Department of Labour — University Research Program

Grants ranging up to $5,000 a year are provided for research studies in the field of labour relations and labour economics. Applications are accepted from graduate students and university faculty members, provided they are Canadian citizens or can demonstrate they will be residing in Canada on a continuing basis. For further information and application forms, write to The Secretary, Department of Labour — University Research Committee, Economics and Research Branch, Canada Department of Labour, Ottawa, Ontario K1A 0J2. Applications must be received by February 15.

Canadian Wildlife Service Scholarships

The Canadian Wildlife Service offers Canadian citizens postgraduate scholarships tenable at Canadian universities during 1976-77. These scholarships, valued at $1,200, are available to students enrolled in a program in an aspect of terrestrial wildlife biology. Applications are available in the Graduate Studies Office. Deadline is June 1.

Awards for Research and Study in Mental Retardation

The National Institute on Mental Retardation offers two awards to students entering or pursuing graduate studies at a Canadian university and planning to pursue a career in the field of Mental Retardation in Canada. Type A is for bursary support, valued at $1,500 for graduate studies in Canada. Type B is for study and/or research support, valued up to $3,000 for a three year period. Successful candidates will be required to attend basic and advanced orientation at the National Institute on Mental Retardation in August 1976 and again in August 1977. Travel and living allowance will be prepaid for these symposia.

For application forms contact Awards for Research and Study in Mental Retardation, National Institute on Mental Retardation, York University Campus, 4700 Keele Street, Downsview, Ontario.

Franki Fellowship

The fellowship is offered to a graduate student in science, engineering or agriculture at a Canadian university to further the advancement of science of soil mechanics in Canada. The value of the fellowship is $2,500 for the student and $500 for the directing professor.

The university is responsible for the choice of candidates and must inform Franki Canada Limited in writing before April 15. For further information write to Franki Canada Limited, 1320 Graham Boulevard, Montreal, Quebec H3P 2C4.

Grants and Loans

Ontario Student Assistance Program

All students who are residents of Ontario, Canadian citizens or landed immigrants, and who satisfy the admission requirements of a Canadian university or an eligible post-secondary institution in Ontario may apply for an award under this program.

To receive an award a student must establish a need for assistance and enroll in an eligible institution in the year of the award. An award under this program will be made to the extent of established need in a combination of a non-repayable grant and a Canada Student Loan. Application forms are available from the Awards Office at Carleton. Deadline date for applications is July 1 for replies prior to fall registration.

Canada Student Loans Plan

Students who do not qualify for financial assistance under the Ontario Student Assistance Program may apply for a Canada Student Loan.

Application forms and a brochure containing details of the plan, including conditions of eligibility, may be obtained from the Awards Office at Carleton University.

Departmental Program Descriptions and Details of Courses

Faculty of Arts

(Humanities)

Dean: James Downey

Department of Art History

The Department

Chairman of the Department: David Burnett

The Department of Art History offers two courses at the graduate level, under the aegis of the Institute of Canadian Studies.

Graduate Courses*

• Art History 11.505T2
Selected Aspects of Canadian Art History
A Tutorial to study specific areas of Canadian art in the Pre-Confederation and Post-Confederation periods.
Prerequisite: Honours courses in Art History or permission of the Departmental Chairman.
Departmental co-ordinator and members of the Curatorial Staff, National Gallery of Canada.

• Art History 11.506F1, W1, S1
Directed Reading and Research
Tutorials designed to permit advanced students to pursue topics in Canadian art which they have selected in consultation with the staff.
Prerequisite: Permission of Departmental Chairman and the Institute of Canadian Studies.
Departmental co-ordinator and members of the Curatorial Staff, National Gallery of Canada.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Institute of Canadian Studies

The Institute

Director of the Institute: Davidson Dunton
Visiting Fellow: David Lewis
General Editor, Carleton Library:
Michael Gnarowski

The Institute of Canadian Studies offers programs of study and research leading to the degree of Master of Arts in Canadian Studies.

Through the medium of the Institute, the following departments co-operate in offering the programs:
Art History, Economics, English, French, Geography, History, Journalism, Law, Music, Political Science, Psychology, and Sociology/ Anthropology.

The Canadian Studies program is interdisciplinary in emphasis. It enables students in the Institute to develop individual programs to meet particular interests in a broad range of Canadian issues.

Among special areas in which it is possible to build individual programs are: *communications; regional studies; urban studies; French-Canadian studies; native peoples; Canadian art history and music;* and *studies in Canadian literature.*

The proximity of Carleton University to the National Library, the Library of Parliament, the Public Archives of Canada, Statistics Canada, and the libraries of various government departments and embassies, ensures excellent research facilities for graduate candidates in Canadian Studies.

The Institute of Canadian Studies sponsors and gives editorial supervision to the *Carleton Library*, a series of paperback reprints and compilations of classic material relating to Canadian history, law, economics, politics, anthropology, sociology, geography and journalism. There are 100 volumes to date.

A new series, *Carleton Contemporaries*, launched in 1968, consists of original monographs and compilations focussing on the issues of the day—political, social, economic, cultural.

Further information can be obtained by writing directly to the Institute.

Qualifying Year Program

Applicants with general (pass) Bachelor's degrees with high second-class standing, will be required to successfully complete a Qualifying Year of study before proceeding to the Master's program.

Refer to the general section of this Calendar for the regulations governing the Qualifying Year.

Master of Arts

Admission Requirements

Applicants must normally hold an Honours B.A. (or the equivalent), with at least high second-class standing, in one of the disciplines represented in the Institute.

A reading knowledge of French is a prerequisite for admission.

Program Requirements

The minimum requirements for the Master's program are outlined in the general regulations section of this Calendar. The Institute of Canadian Studies specifies that all candidates must select one of the following program patterns:

- three full courses or the equivalent; a thesis; and an oral comprehensive examination;
- four full courses or the equivalent; a research essay; and an oral comprehensive examination.

Graduate Courses*

- Canadian Studies 12.500T2
Modern Concepts of Canada
Interdisciplinary seminar.
Davidson Dunton.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

- Canadian Studies 12.590F1, W1, S1 or T2, S2
Directed Studies
Reading and research tutorials.

- Canadian Studies 12.598F2, W2, S2
Research Essay

- Canadian Studies 12.599F4, W4, S4
M.A. Thesis

Selection of Courses

In addition to the graduate courses offered by the Institute, the following selection of courses is open to Master's and Qualifying Year students in Canadian Studies:

Art History
11.300 Canadian Painting
11.305 Canadian Architecture
11.307 Eskimo Art
11.407 Eskimo Art Studies
11.505 Selected Aspects of Canadian Art History
11.506 Directed Reading and Research

Economics
43.300 Labour Economics
43.325 The Economic Development of Canada
43.330 Social Economics
43.340 Problems of Area Development
43.357 Introduction to Industrial Relations
43.380 Topics in Canadian Economic Policy
43.465 Industrial Relations
43.480 Urban Economics
43.511 The Canadian Economy
43.512 Workshop on the Canadian Economy
43.530 Industrial Organization
43.540 Public Finance
43.580 Urban Analysis
43.581 Regional Analysis

English
18.381 Studies in Canadian Poetry
18.383 Studies in Canadian Fiction
18.387 Selected Topic in Canadian Literature
18.483 Seminar in Canadian Fiction
18.487 Special Topic in Canadian Literature
18.581 Studies in Canadian Poetry
18.583 Studies in Canadian Fiction
18.587 Studies in Canadian Literature

French
20.335 L'Evolution de la pensée du Canada français
20.465 Littérature et mouvement des Idées au Canada français, 1840–1900
20.520 Aspects de la littérature canadienne
20.465 Le roman Québécois depuis 1960
20.520 Le développement du théâtre au Canada français

Geography
45.305 Geography of Canada
45.320 Urban Geography
45.333 Land Use, Regional Development and Planning in Canada
45.334 Renewable Resource Planning in a Local Area
45.351 Geography of the Northlands
45.441 Advanced Economic Geography
45.543 Selected Concepts in Cultural Geography
45.571 Selected Studies in the Human Geography of Arctic and Subarctic Lands
45.572 Problems in Canadian Resource Development
45.579 Research and Development in Recreational Geography

History
24.325 See Economics 43.325
24.330 Social History of Canada
24.331 French Canada since Confederation
24.332 The Maritime Provinces 1750-1900
24.334 Canada-United States Relations
24.336 Canadian External Relations
24.337 The Emergence of the Political Tradition in Canada
24.430 Selected Problems in the Social and Economic History of Upper and Lower Canada
24.432 Seminar on Acadian History
24.435 Confederation
24.438 Selected Problems in Canadian Labour History 1873–1956
24.532 Studies in the Commercial and Political History of Upper Canada and Ontario, 1815–1880
24.534 Problems in the Study of Canadian Nationalism 1867-1918
24.536 Canada Between the Wars, 1919-1939
24.570 Problems in the Imperial History, with particular reference to British North America
24.588 The Historiography of North America

Journalism
28.301 Media Research
28.351 and 28.352 See Law 51.351, 51.352
28.422 Communications Research
28.423 Quantitative Methods in Media
28.434 Media and Society I
28.435 Media and Society II
28.461 Perspectives on Modern Society
28.462 Public Issues in Canada

Law
51.301 Woman and the Legal Process
51.351 Communications Law I
51.352 Communications Law II
51.353 Civil Liberties and Human Rights
51.374 Local Government Law
51.380 Law of Environmental Quality
51.387 Quebec Law
51.450 Canadian Constitutional Law
51.453 Law and Native Peoples of Canada
51.455 Law of Public Authorities I
51.491 Tutorial in Law (Problems of Federalism)
51.555 Law of Public Authorities II

Music
30.310 Music in Canada 1600-1900
30.311 Canadian Music in the Twentieth Century
30.510 Canadian Music

Political Science
47.300 Provincial Government and Politics
47.301 Intergovernmental Relations
47.302 Canadian Municipal Government
47.303 Canadian Urban Politics
47.304 Political Parties and Elections in Canada
47.335 Sources and Development of Canadian Political Ideas
47.336 Canadian Political Culture and Ideologies
47.340 Canadian Public Administration
47.366 Canadian Foreign Policy
47.400 Topics in Canadian Government and Politics
47.401 Policy Making in Canada
47.402 Policy Seminar
47.403 Politics and the Media
47.404 Interest Groups in Canadian Politics
47.405 Federalism
47.406 Legislative Process in Canada
47.409 French Canadian Politics
47.500 Problems of Canadian Local Government and Politics
47.501 Problems of Canadian Provincial Government and Politics
47.504 Urban Politics
47.506 Problems of Canadian Government and Politics: I
47.507 Problems of Canadian Government and Politics: II
47.510 The Political Process in Canada
47.520 Nationalism
47.535 The Canadian and American Political Traditions
47.540 Problems in Canadian Public Administration
47.561 Development of Canadian External Relations

Psychology
49.590 Directed Study

Sociology
56.320 French Canadian Society
53.345 Stratification and Mobility
53.400 Sociological Analysis
53.525 Canadian Society
53.545 Power and Stratification

With the approval of the Institute, certain other courses may be selected.

The Department

Chairman of the Department: D.G. Beer

The Department of Classics offers programs of study leading to the degree of Master of Arts. The following three program categories are available:

- Classics
- Greek only
- Latin only

Qualifying Year

Applicants who hold a general (pass) B.A. degree will normally be required to complete successfully a Qualifying Year program before proceeding to the Master's program. Refer to the general section of this Calendar for the regulations governing a Qualifying Year.

Program Requirements

The Qualifying Year program will correspond quite closely to the final year of the Honours undergraduate program offered by the Department of Classics, although it may include graduate courses.

Master of Arts

Admission Requirements

The minimum requirement for admission to the Master's program is an Honours B.A. degree in Classical Civilization, Ancient History, Classics, Latin, or Greek.

Program Requirements

The regulations governing program requirements are outlined in the general section of this Calendar. Master's students will normally be required to complete three full courses (or the equivalent) at the 500 level, and a thesis equivalent to two full courses.

The Department also specifies the following:

- Students entering the program with a degree in Classical Civilization must have a knowledge of Latin or Greek to the level of 16.015 or 15.015 (or the equivalent), and must, before graduating, have Latin or Greek to the level of 16.100 or 15.100 (or the equivalent) and the other of the two languages to the level of 16.015 or 15.015 (or the equivalent).
- Students taking the degree in Greek only must have credit in Senior Matriculation Latin or an approved equivalent; those in Latin only must have credit in Greek 15.015 (or the equivalent).
- All students must demonstrate a knowledge of German. Credit in German 22.015, or an approved equivalent, will be accepted.

Graduate Courses*

- Classics 14.505F1
Introduction to Linguistics
- Classics 14.506W1
Elementary Textual Criticism
- Classics 14.520T2
A Greek Author
- Classics 14.521T2
A Latin Author
- Classics 14.530T2
A Greek Literary Genre
- Classics 14.531T2
A Latin Literary Genre
- Classics 14.550T2
A Greek Historical Period
- Classics 14.551T2
A Roman Historical Period
- Classics 14.552T2
A Topic in Greek and Roman History
- Classics 14.599F4, W4, S4
M.A. Thesis

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Comparative Literature Committee

The Committee

Chairman of the Committee: Eva Kushner
Associate Chairman: C.A. Marsden

The Comparative Literature Committee offers programs of graduate study leading to the degree of Master of Arts.

The purpose of the Comparative Literature program is to study literature in its international context, and to relate and compare literary phenomena usually studied in isolation because of linguistic barriers and the traditional departmental division of academic disciplines. Thus, taking into account the interrelation of all humanistic studies such as the various literatures, philosophy, psychology, sociology, the visual arts and history, "comparatists" view literary creation within the total complex evolution of world literature. The historical flow of literary archetypes, the role of folklore and myth in literature, recurrent problems of literary theory, consideration of the less well-known literatures of the world, are some of the objects of Comparative Literature studies.

The study of this discipline must be based on a truly comparative perspective, on a solid linguistic foundation and on an awareness of all difficulties that arise in Comparative Literature conceived as a domain both within and beyond limits of national literatures.

Students registered in other language departments, who wish to register in one or more courses from the Comparative Literature program, must demonstrate a reading knowledge of the languages required for each course. Three years of study at the university level will normally constitute the required level of language proficiency.

Qualifying Year Program

Applicants who hold only a general (pass) B.A. degree will be required to complete successfully any two of the following four basic qualifying courses while pursuing their special interests in the field:

- Comparative Literature 17.410
  Critical Approaches to Literature I: Linguistic Stylistics
- Comparative Literature 17.420
  Critical Approaches to Literature II: Historical and Aesthetic
- Comparative Literature 17.430
  Critical Approaches to Literature III: Psychological Criticism
- Comparative Literature 17.440
  Critical Approaches to Literature IV: Sociology of Literature

The total course program is to be worked out in consultation with the Graduate Studies' Supervisor. Formal admission to the Master's program may be considered at the end of the first term.

Master of Arts

Admission Requirements

The regulations governing admission to the Master's program are outlined in the general section of this Calendar.

The specific requirements for admission to the Master's program in Comparative Literature are the following:

- An Honours B.A. degree (or the equivalent) with at least second-class standing, including two full literature courses at the senior undergraduate level in each of the two language fields (studied in the original language). Candidates who hold degrees in only one national literature will be required to take additional courses or to register in the Qualifying Year program.
- In addition to proficiency in English, students must have a comprehensive knowledge of either French or German (including the ability to read primary and secondary sources in that language and to participate occasionally in class discussions in that language).
- A reading knowledge of at least one additional language from among the following: French, German, Spanish, Italian, Russian, Latin or classical Greek. In special cases the Committee may permit the substitution of some other language. Three years of study at the university level will normally constitute the required level of language proficiency. The Com-

mittee reserves the right to test proficiency and reading knowledge by examination.

Program Requirements

The program requirements for Master's candidates in Comparative Literature are the following:

- Comparative Literature 17.501
Theory of Literature and Standard Problems in Comparative Literature
- The two basic full courses listed above in the Qualifying Year program; students who have already taken one or more of these courses (or the equivalent) will substitute other appropriate Comparative Literature courses (not including 17.593, 17.594 and 17.595).
- One of the following:
Comparative Literature 17.599
M.A. Thesis; or two additional courses in Comparative Literature (not including 17.593, 17.594 and 17.595).
- A final comprehensive examination (written and oral).

In all cases the Committee will prescribe a program of studies that will complement the student's background and special interest.

Graduate Courses*

A prerequisite for all graduate level courses is appropriate linguistic ability and approval of the Comparative Literature Committee.

- Comparative Literature 17.501T2
Theory of Literature and Standard Problems in Comparative Literature
The course will combine the study of theory and its applicability within the field of modern literature. Russian Formalism, Phenomenological approach to Literature (Ingarden), New criticism, Czech Structuralism and French "La Nouvelle Critique."
Selections from: Cervantes, Dostoyevski, Strindberg, Pirandello, Musil, Gide, Sartre, Baudelaire, W. Stevens, O. Paz, E. Montale, Fr. Ponge.
Prerequisite: Proficiency in French.
W. Krysinski.

- Comparative Literature 17.506T2
Periods
Topic: Modern Drama
A survey of major dramatists and the themes and theatrical traditions which they represent, from Ibsen and Strindberg to the present. (Cross-listed as English 18.564)
Prerequisite: Reading knowledge of two appropriate languages other than English.
G. Wood.

- Comparative Literature 17.507T2
Study of a Theme or Motif
Topic: The Medieval Tristan
The *Tristan* story in medieval Germany, England, France, and Scandinavia; emphasis on Gottfried's *Tristan*. Also included is a study of medieval manuscripts.
Prerequisite: Reading knowledge of Middle High German and Old French or Old Norse.
G. Aagaard Woods.

- Comparative Literature 17.525W1
Literary movements in the XIX and XXth centuries
Topic: Surrealism in Latin America: historical perspectives, convergences and differences, thematic structures
The multi-cultural character of Surrealism in Latin America will appear through the ideologies and the aesthetic qualities of Aldo Pellegrini (Argentina), Enrique Gómez-Correa (Chile), César Moro (Peru), Octavio Paz (Mexico) and the problem of "intertextuality" between them will be studied.
Prerequisite: Good knowledge of French and Spanish.
H.-G. Ruprecht.

- Comparative Literature 17.561T2
Studies in Literary Genres
Topic: The Picaresque Novel from the *Lazarillo* to *Moll Flanders*: A Look at Recent Interpretations
In the study of selected major picaresque novels, attention will be paid to such interpretations as those of Chandler, Parker, Del Monte, Bataillon, and Claudio Guillén, and

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discussion of whether a new interpretation of the genre is needed.
(Cross-listed as 38.520)
Prerequisite: Reading knowledge of Spanish or French.
C.A. Marsden.

• Comparative Literature 17.590F1
Seminar in Comparative Literature
Fundamental ideological attitudes to international relations as seen through literary works.
Topic: Cosmopolitanism and Internationalism
Imaginary situations and actions analogous to reality imply an ideological layer of meaning which may be related to international relations. Cultural analyses allow relevant case-studies: students will choose among classical and modern works of fiction.
Prerequisite: One language other than English relevant to the course.
S. Sarkany.

• Comparative Literature 17.591T2
Seminar in Comparative Literature
Topic: Marxist Theory and Criticism of Literature
General perspective and conceptual tools. Literature as institution in history, its economic and ideological conditions; cultures and counter-culture today. The Marxist reading of text: communication of ideological contents through the medium of fiction; the public's role in confrontation with semantic polyvalence.
(Cross-listed as 20.585)
Prerequisite: Proficiency in French.
S. Sarkany.

• Comparative Literature 17.592T2
Literary Criticism
Seminar in Comparative Literature
A study of four major twentieth-century critics: T.S. Eliot, Cleanth Brooks, Northrop Frye, and Lucien Goldmann.
(Cross-listed as 18.500)
Prerequisite: Good knowledge of French.
T.H. Coulson, V.K. Chari, R.H. MacDonald and J. Steele.

• Comparative Literature 17.593F1, W1, S1
Selected Readings
This course is designed specifically to assist students in the preparation for their Comprehensive Examinations.

• Comparative Literature 17.597F1, W1, S1
Directed Special Studies
From time to time students, whose main interests are not covered by courses offered in a given year, may pursue independent research subject to the availability of a qualified adviser and relevant library resources at Carleton. Interested students should apply directly to the Supervisor of Graduate Studies.

• Comparative Literature 17.598T2
Directed Special Studies
(see the description of 17.597)

• Comparative Literature 17.599F4, W4, S4
M.A. Thesis

Courses not offered in 1976-77:
17.505 Translation Workshop
17.530 Literary Archetypes

Department of English Language and Literature

The Department

Chairman of the Department: James Steele
Departmental Supervisor of Graduate Studies: R.G. Laird

The Department of English offers programs of study leading to the M.A. degree in English Language and Literature. Additional information may be obtained by consulting the Departmental Supervisor of Graduate Studies.

Qualifying Year Program

Applicants who hold a general (pass) B.A. degree with at least B– standing, with a major in English Language and Literature, may be admitted to the Qualifying Year program. Normally, these students will be required to complete four or five full courses (or the equivalent) in English as determined by the Department and to maintain at least a B– average in the Qualifying Year courses, before being considered for admission into the Master's program.

Master of Arts

Admission Requirements

The minimum admission requirement for the Master's program is an Honours B.A. (or the equivalent) in English Language and Literature, with at least a B– average and including at least five of the following areas:

- History of the English Language or General English Linguistics
- Old English or Middle English
- Renaissance Literature
- Drama (including Shakespeare)
- Restoration and Eighteenth-Century Literature
- Romantic and Nineteenth-Century Literature
- Twentieth-Century Literature
- Canadian Literature

Possession of the minimum entrance standing is not in itself, however, an assurance of admission into the program.

Program Requirements

Each candidate will select one of the following optional program patterns:

- Three full courses (or the equivalent) in English, including English 18.597 (Special Topic Studies), selected from those offered at the 500 level (except 18.598) and a Master's thesis. An oral examination on the thesis and related fields will also be undertaken.
- Five full courses (or the equivalent) in English, including English 18.598 (Directed Special Studies), selected from those offered at the 500 level (except 18.597).

Under certain conditions, one of the optional courses in either program pattern may be selected from those offered by the Department of English at the senior undergraduate level in a field for which no graduate course is available. One of the optional courses may also be a cognate course at the graduate or the senior undergraduate level offered by another department. However, not more than one undergraduate course may be included in the total program.

All candidates are required to demonstrate a reading knowledge of one language other than English approved by the Department.

Academic Standing

A standing of B– or better must be obtained in each course counted towards the Master's degree.

Financial Assistance

A limited number of graduate teaching assistantships are available for adequately qualified M.A. candidates. Refer to the Awards section of this Calendar for further information on these and other forms of assistance.

Graduate Courses*

• English 18.500T2
Literary Criticism
In 1976-77, a study of four major twentieth-century critics: T.S. Eliot, Cleanth Brooks, Northrop Frye, and Lucien Goldmann.
T.H. Coulson, V.K. Chari, R.H. MacDonald and J. Steele.

• English 18.527F1
Chaucer
A study of *The Canterbury Tales*, together with contemporary background and current critical writings.
E.D. Padolsky.

• English 18.528S1
Middle English Studies
A study of the Towneley cycle of English mystery plays. Emphasis will be on the dramatic and literary qualities of the cycle in the context of its background and production.
E.D. Padolsky.

• English 18.531T2
Milton
A critical study of the major works, chiefly *Paradise Lost*, *Paradise Regained*, and *Samson Agonistes*, with some attention to Milton's development and his cultural context.
L.A. Mann.

• English 18.536T2
Shakespeare
A study of selected works of Shakespeare and his literary background.
A.D. McLay.

• English 18.537W1
Spenser
A study of *The Faerie Queen*, together with background and current critical writings.
D.J. Wurtele.

• English 18.548T2
Studies in Romanticism
A detailed study of Wordsworth and Keats, their theory and practice of poetry, and the interplay of imagination and experience as expressed in their works.
S.C. Russell.

• English 18.551T2
Major Victorian Poets
A study of major poets and poetic movements of the period 1830-1880, including Tennyson, Browning, Clough, Arnold, the Pre-Raphaelites, and Hopkins, in connection with critical theory and historical problems.
R.B. Rutland.

• English 18.553T2
The Nineteenth-Century Novel
An examination of selected novels of the Brontes, Dickens, Thackeray, Eliot and Hardy.
T.G. Middlebro'.

• English 18.561T2
Twentieth-Century Poetry
In 1976-77 a study of the works of Eliot, Stevens and Williams, with particular reference to their conceptions of poetry.
A.T. Tolley.

• English 18.564T2
Modern Drama
A survey of major dramatists and the themes and theatrical traditions which they represent from Ibsen and Strindberg to the present.
G.J. Wood.

• English 18.566S1
D.H. Lawrence
The art of fiction as exemplified in Lawrence's theory and practice.
K.G. Wilson.

• English 18.566F1
Henry James
The art of fiction as exemplified in James's theory and practice. Major writings from all phases of his career will be considered.
A.M. Beattie.

• English 18.567W1
Studies in Modern Fiction Writers
In 1976-77, a study of the work of James Joyce with major emphasis on *A Portrait of the Artist as a Young Man* and *Ulysses*.
T.H. Coulson.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

• English 18.568W1
Twentieth-Century Studies
In 1976-77, a study of experiments in fiction in the twentieth century.
A.M. Beattie.

• English 18.581T2
Studies in Canadian Poetry
Duncan Campbell Scott: a study of the man, his poetry, and its relation to poetry in Canada from 1867 to 1945. There will be substantial use of original documents.
R.L. McDougall.

• English 18.583T2
Studies in Canadian Fiction
In 1976-77, the course will concentrate on selected writings of Thomas Haliburton, Stephen Leacock, and Robertson Davies.
M.J. Edwards.

• English 18.587S2
Studies in Canadian Literature
A study of "modernism" in Canadian poetry, 1920-1960. The poetry and criticism to be considered include that of A.J.M. Smith, Scott, Layton, Dudek, Souster, Cohen, Purdy and Alden Nowlan.
M.M. Gnarowski.

• English 18.587T2
Studies in Canadian Literature
In 1976-77 the seminar will concern itself primarily with methods and techniques of literary scholarship and bibliography as they apply to Canadian literature.
M.M. Gnarowski.

• English 18.590T2
Selected Topic
In 1976-77, Augustan Irony: A study of Swift, Pope, Johnson, Sterne, Fielding and Austen.
R.B. Lovejoy.

• English 18.597T2
Special Topic Studies
All thesis students will be assigned to an adviser (normally their thesis supervisor) for special tutorials in the general area of their thesis research. There will also be a series of lectures on bibliography and research methods.

• English 18.598T2, S2
Directed Special Studies
All students in the M.A. course programme will be assigned to an adviser who will direct their area of Special Studies, preparing them for an oral examination in that area.

• English 18.599F4, W4, S4
M.A. Thesis

Generally, all members of the Department are available for advising in 18.597, 18.598, and 18.599.

Courses not offered in 1976-77:
18.518 Studies in Old Norse
18.521 Middle English Poetry
18.522 Middle English
18.532 Seventeenth-Century Studies
18.538 Renaissance Studies
18.543 Eighteenth-Century Novel
18.563 The Modern Novel
18.571 Studies in American Poetry
18.578 Studies in American Fiction
18.594 Special Studies in Dramatic Literature

Department of French

The Department

Chairman of the Department: Peter Clive
Departmental Supervisor of Graduate Studies: E.F. Kaye

The Department of French offers a program of studies leading to the degree of Master of Arts in French language and literature.

Qualifying Year Program

Applicants who hold a general (pass) Bachelor's degree with second-class standing or higher, with a major in French, will be required to register in the Qualifying Year program (normally five courses in French chosen from those numbered at the 400 level), and maintain at least B– standing in each of these courses, before proceeding to the M.A. program.

Master of Arts

Admission Requirements

The normal requirement for admission into the Master's program is an Honours B.A. in French with second-class standing.

Program Requirements

Master's candidates are normally required to enroll in five full courses (or the equivalent) of which at least three must be chosen from those numbered at the 500 level.

All Master's students must undertake a comprehensive examination (written and oral). The written part will consist of questions based on a reading list of approximately six texts, and the oral section will consist of a series of general questions. The syllabus for this examination will be distributed in December, and it will be undertaken in either May or September.

With the approval of the Department, Master's students in French may select a Comparative Literature course in partial fulfillment of their program requirements.

Academic Standing

A grade of at least B– must be obtained in each course counted for credit towards the Master's degree.

Selection of Courses

The following senior undergraduate courses are open to students in the Qualifying Year program and, with the approval of the Department, to students in the M.A. program:

French
20.405T2 Introduction à linguistique française
20.440T2 Technique du roman français (1880-1920)
20.450T2 Rutebeuf et Villon
20.460T2 Le théâtre au dix-huitième siècle
20.465T2 Roman et idéologie au Québec depuis 1960
20.470T2 Démocratie et discours littéraire au XIXe siècle
20.470S1 Emile Zola, romancier naturaliste

Graduate Courses*

The graduate courses offered by the Department are open to students in the M.A. program and, with permission of the Department, to students in the Qualifying Year program. For prerequisites, please consult the Department.

- French 20.520T2
Aspects de la littérature canadienne-française
Le théâtre québécois: origines, développement, structures, dramaturges principaux et leurs oeuvres.
J. Tassie.

- French 20.540T2
Aspects de la littérature du XVIIIe siècle

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Jean-Jacques Rousseau: les écrits intimes, *Confessions*, *Dialogues*, *Rêveries*, etc.
M. Gaulin.

• French 20.550T2
Aspects de la littérature du XXe siècle
Ecriture, lecture: théorie et pratique du nouveau roman: Butor, Robbe-Grillet, Sarraute, Simon etc.
E. Zimmerman.

• French 20.570T2
Seminar on a particular author
Albert Camus ou la quête du bonheur: l'écrivain engagé, le penseur, l'artiste.
A. Elbaz.

• French 20.585T2
Seminar on a problem of literary history
Théorie et critique de la littérature: L'institution de la littérature et lectures marxistes de grands textes français. La littérature comme institution sociale; lectures marxistes de textes narratifs français du XXe siècle.
S. Sarkany.

• French 20.585S1
Le point de vue social dans la critique moderne de Diderot à Roland Barthes.
S. Sarkany.

• French 20.590T2
Etudes dirigées

• French 20.599F4, W4, S4
M.A. Thesis

Courses not offered in 1976-77:
20.401 Stylistique
20.402 La bibliographie
20.403 Histoire de la langue française
20.430 La critique littéraire en France
20.490 Tutorial
20.498 Initiation à la recherche
20.501 Aspects de la linguistique
20.525 Aspects de la littérature médiévale
20.530 Aspects de la Renaissance
20.535 Aspects de la littérature du XVIIe siècle
20.545 Aspects de littérature du XIXe siècle.

Department of German

The Department

Chairman of the Department: Robert Gould
Departmental Supervisor of Graduate Studies: Basil Mogridge

The Department of German offers programs of study leading to the degree of Master of Arts. These include courses on all major periods in German literature, genres, themes and a number of individual authors, as well as on aspects of literary theory and the study of the German language. The Age of Goethe figures prominently in the teaching and research of the Department, which offers a favourable setting for specialized studies in this period.

Departmental requirements conform to those outlined for Master's students in the general regulations section of this Calendar. Further information concerning graduate work in German can be obtained from the Department.

Program Requirements

Master's students in German will normally be required to select and follow one of the following optional program patterns:

- three full courses (or the equivalent) and a thesis;
- four full courses (or the equivalent) and a research essay;
- five full courses, or the equivalent.

German 22.590 is an obligatory course for all graduate students (full course credit).

All Master's students are also required to undertake a comprehensive examination, based on a departmental reading list.

Selection of Courses

The following senior undergraduate courses are open, with the approval of the Department, to students in the M.A. program. Students in the Qualifying Year program may take additional undergraduate courses.

German

22.412 History of the German Language
22.430 Medieval Language and Literature
22.451 Goethe (I)
22.452 Goethe (II)
22.460 German Romanticism
22.470 Seminar on a Literary or Linguistic Topic
22.471 Seminar on a Selected Topic
22.490 Tutorial
22.491 Tutorial

Graduate Courses*

- German 22.540F1
Genres in German Literature
Goethe's lyric poetry and autobiography. Selected poems mentioned in *Dichtung und Wahrheit;* and the autobiographer's attitude towards them; Goethe's changing outlook and the nature of the two genres.
Robert Gould.

- German 22.541T2
Genres in German Literature
Struktur des modernen Romans. Erzählerfigur und Zeitbegriff als Strukturelemente in Thomas Mann's *Doktor Faustus*, Kafka's *Das Schloss*, Grass' *Hundejahre.*
Jutta Goheen.

- German 22.550W1
Prevalent Themes in German Literature
Citizen, bourgeois, philistine.
The literary history of these concepts from Brentano to Barlach.
Basil Mogridge.

- German 22.570F1
Individual Authors
H.J.Chr. v. Grimmelshausen: *Simplicissimus.* Gesamtstruktur und Absicht (auch der *Continuatio*). Autobiographie und Zeitgeschichte im Spiegel des Romans, künstlerische Umgestaltung der verschiedensten

*F,W,S indicates term of offering.
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Quellen, Grundsätze der Allegorese.
J.B. Dallett.

• German 22.572W1
Individual Authors
Heinrich von Kleist.
E.M. Oppenheimer.

• German 22.590
Directed Studies
An obligatory course of supervised study in preparation for the Comprehensive Examination.

• German 22.591F1, W1
Special Topic
Tutorial.

• German 22.598F2, W2, S2
Research Essay

• German 22.599F4, W4, S4
M.A. Thesis

Courses not offered in 1976-77:
22.530 Literary Theory: Mimesis, Poiesis, and Politics
22.531 Literary Theory: Poetry and Science
22.542 Genres in German Literature: Austrian Drama
22.543 Genres in German Literature: The Short Story
22.560 Period Studies: Dichter und Tradition in mittelalterlicher Lyrik
22.561 Period Studies: Madness and Hallucination in German Romanticism
22.562 Period Studies: Community in Fiction: Bobrowski and V.S. Naipaul
22.571 Individual Authors: C.M. Wieland
22.573 Individual Authors: R.M. Rilke
22.580 Linguistic Problems

Department of History

The Department

Chairman of the Department: P.J. King
Departmental Supervisor of Graduate Studies: S.F. Wise

The Department of History offers programs of study and research leading to the degrees of Master of Arts and Doctor of Philosophy.

Master of Arts

Admission Requirements

The minimum requirement for admission to the Master's program is an Honours bachelor's degree (or the equivalent) with at least second-class standing.

The Department offers no Qualifying Year program; applicants with a general (pass) degree may be considered for admission into the fourth year of Carleton's Honours B.A. program.

Program Requirements in Canadian History

- History 24.588
a seminar in the historiography of North America;
- History 24.590
preparation for a written M.A. field examination (two full course credits);
- Either History 24.599
thesis and participation in appropriate seminar; *or*
two additional graduate seminars, one of which may be an approved seminar in a related field.

Program Requirements in Other Fields

The Department offers the M.A. in fields other than Canadian history for which there are adequate resources in Ottawa. Fields of study to which small numbers of candidates have been admitted are Britain, Modern France, Modern Russia, International History and Medieval History.

Candidates are expected to write a thesis, to follow a program of directed studies in an appropriate field and to write a comprehensive field examination.

The specific requirements are the following:
- History 24.588
directed studies in the historiography of an area of the field of the candidate's admission;
- History 24.590
directed studies in the field of the candidate's admission and preparation for a written comprehensive field examination;
- History 24.599
thesis and participation in an appropriate seminar.

Language Requirements

All candidates are also required to demonstrate a reading knowledge of a language other than English, the choice to depend upon the field of the candidate's thesis or research.

Doctor of Philosophy

Admission Requirements

Applicants with an M.A. degree will be expected to have at least high second-class standing. Applicants with an Honours B.A. with first-class standing may be admitted directly into the Ph.D. program.

Residence Requirements

- a minimum of three years of full-time study after the B.A. Honours degree or two years after the M.A.

Program Requirements

Candidates will be responsible for three fields, one of which will be related to the subject of thesis research and one of which may be in a related discipline. The fields will normally be selected from Canadian history, American history, modern British history and an aspect of modern European history. Each field will cover approximately one century.

There will be written examinations in the two non-thesis fields and one oral comprehensive examination covering all three. These will

be taken, normally, in the May following the beginning of the first Ph.D. year, or not later than September.

A reading knowledge of French will be required. The language examination will be written early in the first post-M.A. year and before the candidate is permitted to take the doctoral fields examination. Proven competence in an additional language may be required if it is pertinent to the candidate's program.

Students entering the program with an Honours B.A. will normally take History 24.588: Historiography of North America; History 24.591: Tutorial in a major field; History 24.592: Tutorial in a selected field; and two other graduate seminars in their first year.

Students entering the second year (i.e., the first post-M.A. year) will be required to follow:

- History 24.688
Social History
- History 24.690
preparation for a general oral Ph.D. examination (equivalent to two full credits).
- Two of
History 24.610: directed studies in an aspect of modern European history; History 24.640: directed studies in United States history; History 24.650: directed studies in British history.
- An approved course of studies in a related discipline appropriate to the candidate's field. Candidates may take an appropriate 500 level seminar.

In the final year of the Ph.D. program, candidates will be required to write a thesis on a topic related to Canadian history.

Graduate Courses*

- History 24.516T2
The French Revolution, 1788-1804
A sound reading knowledge of French is required for admission.
M.J. Sydenham.

- History 24.532T2
Studies in the Commercial and Political History of Upper Canada and Ontario, 1815-1880
J.K. Johnson.

- History 24.534T2
Problems in the Study of Canadian Nationalism, 1867-1918
R.T. Clippingdale.

- History 24.536T2
Canada Between the Wars, 1919-1939
H.B. Neatby.

- History 24.560T2
Late Imperial and Revolutionary Russia, 1855-1921
A sound reading knowledge of Russian is required for admission.
R.C. Elwood.

- History 24.570T2
A Seminar in British Imperial History
Research will normally be done on a British North American or Canadian subject considered in an Imperial context between the late eighteenth and early twentieth centuries.
G.P. Browne.

- History 24.588T2
Historiography
A seminar or course of directed studies comprising one of the following fields:

North America
A course primarily for graduate students in Canadian history, in which the trends and methods of historical writing on North America will be examined.
P.J. King and S.R. Mealing.

Britain
The intensive study of a range of selected problems in the writing of sixteenth and nineteenth century English history.
Directed studies.
R.B. Goheen and J.N. Cooper.

Modern France
The intensive study of selected problems in the writing of modern French political and social history.
Directed studies.
M.J. Sydenham and E.P. Fitzgerald.

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Modern Russia
Concentrated reading in Russian intellectual history and supervised study of Russian historiography, with emphasis on the 19th century. Reading knowledge of Russian is required.
Directed studies.
R.C. Elwood and John Strong.

International History
Trends in the writing of international history in the 19th and 20th centuries.
Directed studies.
M.G. Fry.

Medieval History
Historical method and historiography of the Middle Ages.
Directed studies.
J.G. Bellamy and R.E. Reynolds.

• History 24.590T4, S4
Directed Study
Supervised study in a specified field, in preparation for a written M.A. field examination (equivalent to two full courses).
Directed studies.

• History 24.591T2
Directed Studies in a Canadian Field
Directed studies for Ph.D. candidates in an area of Canadian history appropriate to the candidate's program.

• History 24.592T2
Directed Studies in a Related Field
Directed studies for Ph.D. candidates in a field other than Canadian history appropriate to the candidate's program.

• History 24.599F4, W4, S4
M.A. Thesis
A substantial historical investigation. The subject will be settled in consultation with the Department and a supervisor will be assigned. The candidate will be examined orally after presenting his thesis.

• History 24.610T2
Directed studies in one of the following aspects of Modern European History: Modern France (M.J. Sydenham and E.P. Fitzgerald); Modern Russia (R.C. Elwood and John Strong); and International History (M.G. Fry).

• History 24.640T2
Directed Studies in United States History
P.J. King and E.R. Kantowicz.

• History 24.650T2
Directed studies in British History
J.N. Cooper.

Courses of study in a related discipline which are appropriate to a student's program may be approved by the Department.

• History 24.688T2
Social History
A course, primarily for graduate students in history, in which the literature and methodology of basic aspects of social history will be examined.
J.N. Cooper and others.

• History 24.690F2, W2, S2
Directed study in preparation for a general oral Ph.D. examination.

• History 24.699F, W, S
Ph.D. Thesis

Courses not offered in 1976-77:
24.530 Social and Intellectual History of Pre-Confederation Canada, 1760-1860
24.535 Canada in the North Atlantic World, 1891-1919
24.580 Problems in International History, Theory and Dissent about Foreign Policy, 1900-1941

The School

Director of the School: G. Stuart Adam
Departmental Supervisor of Graduate Studies: T. Joseph Scanlon

The School of Journalism offers courses leading to the degree of Master of Journalism. The emphasis in the Master of Journalism program is on advanced professional education for those who are or intend to become practising journalists in the news media, but there is provision for students who wish to undertake research in journalism and mass media.

Students entering the Master's program will choose one of four areas of concentrated study:

Specialized Reporting
Courses provide advanced training in specialized news beats in journalism such as politics, the economy or international affairs.

Specialized Media
The focus of this specialty will be techniques of television, radio and documentary film. Students will be expected to work to standards of professional competence.

Media and Society
This specialty encompasses a number of topics among which are the law of the press, journalism history, government-press relations, issues in contemporary journalism such as those raised by the ownership and control of publishing and broadcasting in Canada, and an examination of the role of the media in society as it is conceived by selected social and political theorists.

Journalism Research
This will focus on the theories and methods, mainly quantitative, of research into the communication processes with emphasis upon journalism and news media systems.

Carleton's School of Journalism is uniquely situated for advanced journalism study. It offers ready access to many of the people and institutions that most directly influence Canadian affairs: Parliament, federal government departments and agencies, embassies, business and labor organizations and major economic and cultural institutions are close at hand.

Qualifying Year Program

Applicants who have three-year (pass) journalism degrees with high second-class standing may be admitted to a Qualifying Year program made up largely of courses from the Faculty of Arts. An applicant with a background in another discipline who does not have a journalism degree or the equivalent may be admitted to a Qualifying Year of basic professional studies if he or she achieved at least a B average in the previous degree.

Students who complete a Qualifying Year program with high second-class honours may proceed with Master's level studies the following year.

For details of the regulations governing Qualifying Year programs, refer to the general section of this Calendar.

Master of Journalism

Admission Requirements

Admission to the M.J. program is selective. The basic requirement is an Honours B.J. degree with at least second-class standing or its equivalent. Students also are required to have at least four months' practical experience in the media and a working knowledge of a second language, preferably French.

The program of studies to be undertaken must be consistent with the applicant's undergraduate background or professional experience.

Graduate Courses*

Students are required to complete successfully five full courses or the equivalent. Students will have their work evaluated at the end of each

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academic term and those working below a B– level will normally be asked to withdraw.

In 1976–77 most courses will be prescribed and students will be required to take:

• Journalism 28.530F1
Mass Media/Mass Society
Theories used in the analysis of the relationship between mass media and mass societies will be examined.
J.R. Weston.

• Journalism 28.532W1
Press and Government
A critical examination of the press in the political systems of Britain, the United States and Canada. The course will include a research component.
G. Stuart Adam.

• Journalism 28.540T2
Specialized Reporting
A series of seminar-workshops on approaches and problems in one area of reporting, such as politics, labour, science or finance. (Certain of these specialties may not be offered every year.)
Anthony Westell.

• Journalism 28.599F4, W4, S4
M.A. Thesis
The student will complete either a substantial piece of public affairs work in journalism in any medium or a research project on the mass media.

The courses described above constitute four of the required five credits. Students will choose from among the following options to complete their course requirements:

• Journalism 28.521F1
Journalism Research
A laboratory course in design and analysis of mass media research. Under direction, students will undertake all phases of a research project from conceptualization of the problem through reporting findings.
J.R. Weston.

• Journalism 28.522W1
Journalism Research
A seminar course dealing in depth with selected methodological and theoretical issues in media research.
J.R. Weston.

• Journalism 28.588F1
Directed Readings
Students, working under faculty direction, will undertake an intensive reading schedule in order to pursue a subject area of particular interest.

• Journalism 28.589W1
Directed Research
Students, working under faculty direction, will develop and undertake a research project in order to pursue a subject area of particular interest.

With the approval of the School and the participating department, M.J. students may take two half-courses in either Political Science or Economics.

The Department

Chairman of the Department: Alan Gillmor
Departmental Supervisor of Graduate Studies: William Amtmann

The Department of Music offers a course in the History of Canadian Music and related fields at the graduate level in co-operation with the Institute of Canadian Studies. Full use will be made of the resources of the National Library, the Public Archives and the National Museum of Man.

Dr. Roxanne Carlisle (Chief, Ethno-musicological Division, Museum of Man) and Dr. Helmut Kallmann (Chief Music Librarian, National Library) are Adjunct Professors.

Graduate Course*

• Music 30.510T2
History of Canadian Music
Selected aspects of Canadian music from 1600 to 1900; liturgical music; folk music in Canada; music education; social and economic conditions of Canadian musical life. Canadian Ethnomusicology: the music of Indians and Eskimos; the music of ethnic minorities.
Prerequisite: Permission of instructor and the Institute of Canadian Studies.
W. Amtmann.

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The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Department of Philosophy

The Department

Chairman of the Department: J.W. Leyden
Departmental Supervisor of Graduate Studies: B. Wand

The Department of Philosophy offers programs of study leading to the degree of Master of Arts.

Qualifying Year

Applicants who do not hold an Honours degree (or the equivalent) will be required to register in a Qualifying Year program before proceeding to the Master's program.

The regulations governing the Qualifying Year are outlined in the general section of this Calendar.

Master of Arts

Admission Requirements

Applicants for the Master's program must have an Honours degree (or the equivalent) in Philosophy, with at least second-class standing.

Applicants for admission from an institution other than Carleton University must submit two papers.

Program Requirements

The specific program requirements for Master's candidates are the following:

- Philosophy 32.545, the departmental seminar;
- a thesis equivalent to two full course credits, which must be defended at an oral examination;
- four half-course credits in at least three of the following study areas:

studies in the history of philosophy; studies in the work of an individual philosopher; studies in logic, epistemology, or metaphysics; studies in selected problems in philosophy.

In exceptional cases, a maximum of one full course (or the equivalent) may be selected from those offered at the 400 level or in a related field or at another university.

Academic Standing

A grade of B– or better must be obtained in each course, on the thesis, and in the oral defence of the thesis.

Selection of Courses

The following senior undergraduate courses are open to students in the Qualifying Year and, with permission, to students in the M.A. program.

Philosophy
32.406 Descartes
32.407 Hume
32.409 Marx
32.411 Action, Intention and Responsibility
32.416 Mediaeval Philosophy
32.421 Epistemology
32.441 Contemporary, Ethical and Political Philosophy
32.491 Tutorial

This list of courses may be changed slightly. Please consult Undergraduate Calendar listings.

Graduate Courses*

The following graduate courses are open to students in the M.A. program and, with permission, to students in the Qualifying Year program. Five two-hour tutorial sessions will be required in each half-course.

- Philosophy 32.504F1
Tutorial in the History of Philosophy I
Detailed study of a period or issue in the history of philosophy.

- Philosophy 32.505W1
Tutorial in the History of Philosophy II
Detailed study of a period or issue in the history of philosophy.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

• Philosophy 32.514F1
Tutorial in the Work of an Individual Philosopher I
A critical and systematic study of the work of an individual philosopher.

• Philosophy 32.515W1
Tutorial in the Work of an Individual Philosopher II
A critical and systematic study of the work of an individual philosopher.

• Philosophy 32.524F1
Tutorial in Logic, Epistemology or Metaphysics I
An attempt to find a solution to a specific problem in logic, epistemology or metaphysics.

• Philosophy 32.525W1
Tutorial in Logic, Epistemology or Metaphysics II
An attempt to find a solution to a specific problem in logic, epistemology or metaphysics.

• Philosophy 32.534F1
Tutorial in Selected Problems of Philosophy I
An attempt to find a solution to a specific problem in some area, other than logic, epistemology or metaphysics.

• Philosophy 32.535W1
Tutorial in Selected Problems of Philosophy II
An attempt to find a solution to a specific problem in some area, other than logic, epistemology or metaphysics.

• Philosophy 32.545T2
Departmental Seminar
Research papers to be given by faculty members and students.

• Philosophy 32.599F4, W4, S4
M.A. Thesis

Department of Religion

The Department

Chairman of the Department: S.G. Wilson
Departmental Supervisor of Graduate Studies: A.R. Gualtieri

The Department of Religion offers programs of study leading to the degree of Master of Arts.

Master of Arts

Admission Requirements

The minimum requirement for admission to the Master's program is an Honours bachelor's degree in Religion (or the equivalent) with at least second-class standing.

Applicants who do not hold an Honours degree in Religion (or the equivalent) will be required to register in a Qualifying Year program before proceeding to the Master's program.

The regulations governing the Qualifying Year are outlined in the general section of the Calendar of the Faculty of Graduate Studies and Research.

Program Requirements

The student will choose a program of study concentrating on one of the following major areas: (a) Comparative Religion with special emphasis on one of the major traditions; (b) Biblical and Ancient Near Eastern Studies; and (c) Modern Religious Thought and Culture. The specific program requirements will be:

- seminars equivalent to one full course in major area;
- seminar equivalent to one full course, selected from one or both of the other areas;
- tutorial in major area for one course credit;
- thesis (equivalent to two full courses) on a topic in major area, which must be defended at an oral examination.

The student's program will be worked out in consultation with the Department's Supervisor of Graduate Studies and its Committee on Graduate Studies. The prescribed program will take into account the student's background and special interests as well as the research interests and competence of the staff.

Language Requirements

The student will be required to acquire, or to demonstrate that he already has, a reading knowledge of whatever language is essential to his research.

Graduate Courses*

- Religion 34.510F1
Seminar in Comparative Religion: Muslim Attitudes to Other Faiths
A social and religious survey of Muslim attitudes to other faiths from Muhammad to the present.
R. Nettler.

- Religion 34.511W1
Seminar in Comparative Religion: Zen (Ch'an) Buddhism
Historical development of Zen Buddhism; discussion of the writings of Zen masters and Zen literature in general; thematic discussions of Zen approaches to Satori; appreciation of Zen paintings and calligraphy.
D. Chung.

- Religion 34.512T2
Tutorial in Comparative Religion

- Religion 34.520F1
Seminar in Biblical and Near Eastern Studies: Hermeneutics and the Hebrew Bible
Investigation of methods of modern biblical criticism such as form criticism and tradition-history in their relationship to the hermeneutical quest and to new approaches which employ the findings of linguistics, folklore studies, contemporary literary criticism and structuralism.
R.M. Polzin.

- Religion 34.521W1
Seminar in Biblical and Ancient Near Eastern Studies: The Lukan Writings
An examination of the theological and historical problems raised by the Gospel of Luke and the

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The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Acts of the Apostles.
S.G. Wilson.

• Religion 34.522T2
Tutorial in Biblical and Ancient Near Eastern Studies

• Religion 34.530F1
Seminar in Modern Religious Thought and Culture: Christianity and Liberation
An examination of attempts to relate critical theories of Christianity to the praxis of revolution; the relationship between liberation theology and neo-Marxism; and the ethics of violence in revolutionary situations.
J.G. Ramisch.

• Religion 34.531W1
Seminar in Modern Religious Thought and Culture: Myths and Models in Religion
The focus will be on conceptions of God and the self in such contemporary authors as John Donne, Paul Ricoeur and Gordon Kaufman and how these relate to literary, psychological and philosophical approaches.
C.P. Slater.

• Religion 34.532T2
Tutorial in Modern Religious Thought and Culture

• Religion 34.599F4, W4, S4
M.A. Thesis

Department of Spanish

The Department

Chairman of the Department: R. Larson
Departmental Supervisor of Graduate Studies: J. Jurado

The Department of Spanish offers a Master's program with specialization in either Peninsular or Spanish American literature, or a combination of both.

All requests for more information concerning the program should be addressed to the Departmental Supervisor of Graduate Studies. The Department will supply reading lists for individual courses and for the general comprehensive examination, and a brochure containing details of particular requirements and other information related to Spanish studies at Carleton.

Master of Arts

Admission Requirements

The requirements for admission to the Master's program are outlined in the general regulations section of this Calendar.

Program Requirements

The minimum program requirements for Master's candidates are stated in the general regulations section.

The Master's program may be undertaken in one of the following three optional patterns:

- three full courses (or the equivalent, not including 38.595), and a thesis equivalent to two full courses;
- four full courses (or the equivalent, not including 38.595), and a thesis equivalent to one full course;
- five full courses (or the equivalent, not including 38.595).

The Department of Spanish encourages candidates to select one of the thesis patterns.

The Department also requires all students to undertake general comprehensive examinations, and to complete a non-credit seminar on bibliography and research methods.

Students wishing to study aspects of Hispanic literature not specifically offered by the Department may enroll in Spanish 38.590: Directed Studies, if a specialist in the desired field is available.

All courses taken by graduate students shall be chosen in consultation with the Department. From time to time certain courses offered by other departments may be accepted as part of the Master's program in Spanish, and special arrangements can occasionally be made to undertake part of the program at universities in Spanish-speaking countries.

Selection of Courses

The following senior undergraduate courses are open to students in the Qualifying Year program and, with permission, to students in the M.A. program.

Spanish

38.402	Stylistics
38.415	Introduction to Medieval Literature
38.420	Cervantes
38.430	Modern Spanish Novel
38.435	Modern Spanish Theatre
38.440	Modern Spanish Poetry
38.450	Colonial Spanish American Literature
38.460	20th Century Spanish American Novel
38.470	20th Century Spanish American Poetry
38.490	Seminar on a Special Topic
38.491	Special Studies

Graduate Courses*

- Spanish 38.520
Special Topic on Golden Age Literature

(520T2 The Picaresque Novel)
An examination of the Spanish Picaresque novel with reference to the Picaresque in other literatures, in the light of recent interpretations.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

(This course is cross-listed as Comparative Literature 17.561. Students enrolling in the latter will be more concerned with the European than the Spanish aspect.)
C.A. Marsden.

• Spanish 38.525
Studies in Eighteenth-Century Neo-Classicism

(525W1 Eighteenth Century Literature)
Main authors and movements of the period with special emphasis on Luzán, Isla and Cadalso for prose; Meléndez Valdés for poetry; and L. Fernández de Moratín for theatre.
J. Jurado.

• Spanish 38.530
Problems of Modern Spanish Literature

(530F1 Juan Ramón Jiménez and the Modernista Movement in Spain)
An analysis of the characteristics of the modernist movement as seen in the works of various representative poets, and with special emphasis on the contribution of Juan Ramón Jiménez.
A. López-Fernández.

• Spanish 38.560
Aspects of Spanish American Literature after 1888

(560T2 Pablo Neruda and Hispanic Poetry)
A study of the major characteristics and evolution of Neruda's poetic style with special emphasis on repercussions in Hispanic poetry of the innovative social aspects of his work.
A. López-Fernández.

• Spanish 38.590T2 or S2
Directed Studies

• Spanish 38.595F1, W1, S1
Directed Readings
Additional half-courses designed in particular for students needing special assistance in preparing for comprehensive examinations.

• Spanish 38.599F, W, S
M.A. Thesis

Courses not offered in 1976-77:
38.505 History of the Spanish Language
38.515 Aspects of Medieval Literature
38.550 Aspects of Spanish American Literature before 1888
38.570 Special Problems in Spanish American Literature

Departmental Program Descriptions and Details of Courses

Faculty of Arts

(Social Sciences)

Dean: R.A. Wendt

The Department

Chairman of the Department: N.H. Lithwick
Departmental Supervisor of Graduate Studies: K.A.J. Hay

The Department of Economics offers programs of study and research leading to the M.A. and Ph.D. degrees.

Graduate students in Economics undertake a thorough review of economic theory, together with an analysis of the Canadian economy, its institutions and history, and the working of public policy. Stress is placed on the understanding and application of quantitative methods to all aspects of economics. Although the programs are generally oriented towards policy problems, there is considerable opportunity for the development of specialized interests.

The main areas of specialization within the Department include the following:
Industrial Organization
Public Finance
Money and Trade
Urban and Regional Economics
Economic Theory
Quantitative Methods

Qualifying Year Program

Applicants who have a general (pass) Bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a Qualifying Year program designed to raise their standing to Honours status. If successful, they may be permitted to proceed to the Master's program the following year.

Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Arts

Admission Requirements

The normal requirement for admission to the Master's program is an Ontario Honours B.A. (or the equivalent) in Economics, with at least second-class standing.

Applicants are expected to have had an adequate preparation in statistics and mathematics. Credit in the following two undergraduate courses (or their equivalents) will be accepted: Economics 43.220, Statistical Methods in the Social Sciences; and Mathematics 69.100, Introductory Calculus and Algebra; or 69.101, Introductory Mathematics. Students who do not satisfy the Statistics requirement will be asked to take Economics 43.592, Empirical Methods prior to proceeding to Economics 43.505. Econometrics.

The Department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

Program Requirements

All Master's students in Economics are required to complete the following courses:
Economics
43.501 Advanced Micro-Economic Theory
43.502 Advanced Macro-Economic Theory
43.503 Welfare Economics for Policy
43.504 Stabilization Policy
43.505 Econometrics
43.598 M.A. Tutorial

The tutorial serves to prepare candidates for the requirement of completing a written M.A. comprehensive examination. Details of this exam are outlined below.

In addition, each candidate must select and complete one of the following:
- A thesis, equivalent to one and a half credits;
- Approved courses for one and a half credits, one of which may be selected from among those offered in a related discipline with special permission from the Departmental Supervisor of Graduate Studies.

Comprehensive Examinations

Master's candidates in Economics must undertake a written comprehensive examination to demonstrate their knowledge of economic theory and its policy implications.

There may also be an optional oral examination designed to give the student an opportunity

to expand on the answers and solutions submitted in the written parts.

Academic Standing

The Department requires that Master's candidates obtain a grade of B– or better in each course, on the comprehensive examination, and on the thesis (where applicable).

Doctor of Philosophy

The Doctoral program is principally concerned with Canadian Economic Policy.

The course content of the Doctoral program must be undertaken on a full-time basis. Completion of the overall Doctoral requirements entails a minimum of two years of study.

Admission Requirements

The normal requirement for admission into the Ph.D. program is a Master's degree (or the equivalent) from a recognized university.

The Department may require certain applicants to write a comprehensive entrance examination.

Program Requirements

Ph.D. candidates are expected to have or acquire proficiency in mathematics and statistics. This requirement must be satisfied before proceeding with the program.

Doctoral candidates would usually complete:

Economics

43.600 Economic Theory I: Micro-Economics
43.601 Economic Theory II: Macro-Economics
43.602 Analysis of Micro-Economic Policy
43.603 Analysis of Macro-Economic Policy
43.606 Economic Models and Policy Application
43.613 Workshop in Economic Policy

- Five other graduate half-courses (or the equivalent) in Economics. With the permission of the Departmental Supervisor of Graduate Studies, one full course may be selected from a related discipline.
- A formal dissertation which must be defended at an oral examination;
- Three written comprehensive examinations (theory, policy, and an optional field).

Academic Standing

Ph.D. candidates must obtain a grade of B or better in each course and on the comprehensive examinations.

Qualifying Year Courses*

- Economics 43.590F1
Micro-Economic Theory
This course is required for Qualifying Year students whose preparation in micro-economic theory is judged to be inadequate for graduate work in Economics at Carleton University.
S. Wong.

- Economics 43.591W1
Macro-Economic Theory
This course is required for Qualifying Year students whose preparation in macro-economic theory is judged to be inadequate for graduate work in Economics at Carleton University.
K. Marwah.

- Economics 43.592F1
Empirical Methods
Principles of statistical theory, probability, testing and introduction to regression analysis. Designed for those judged deficient in undergraduate statistical training.
D. McFetridge.

- Economics 43.594F1, W1, S1
Qualifying Year Tutorial
A tutorial for Qualifying Year students whose program includes the full slate of Qualifying Year core courses (micro-economic theory, macro-economic theory, empirical methods, and applied economics).

- Economics 43.595F1, W1, S1
Applied Economics

- Economics 43.597F1, W1, S1
Qualifying Year Directed Readings

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Graduate Courses*

Enrolment in the graduate courses requires the permission of the Departmental Supervisor of Graduate Studies.

• Economics 43.501F1
Advanced Micro-Theory
An examination of the theories of the behaviour of individual economic agents: consumers and producers and their relation to the theories of price and distribution. Students are introduced to the controversies in the study of individual economic behaviour.
S. Wong.

• Economics 43.502F1
Advanced Macro-Theory
Various formulations of the consumption, investment and demand for money functions are discussed. Macro-economic models will be presented including analysis of price level determination and inflation.
E.G. Davis.

• Economics 43.503W1
Welfare Economics for Policy
A rigorous exposition of theoretical welfare economics. An introduction to such topics as the role of voting in decision making, the economics of democracy and bureaucracy; the relationship of such forces to the theory of economic policy.
Prerequisite: Economics 43.501.
W.P. Hettich.

• Economics 43.504W1
Stabilization Policy
An examination of policies aimed at achieving internal and external stability. The implications of economic growth for stabilization policies will be discussed.
Prerequisite: Economics 43.502.
K.A.J. Hay.

• Economics 43.505W1
Econometrics
Estimation and hypothesis testing, generalized least squares, autocorrelation; multicollinearity, specification errors, errors in variables, other problems of the standard model. Simultaneous equation models, including identification and applications.
Prerequisites: Economics 43.220, 43.592, or equivalent.
J.C.R. Rowley.

• Economics 43.507F1, W1, S1
Directed Readings
Prerequisite: Permission of the Chairman.

• Economics 43.511W1
Canadian Economy I
A detailed examination of aspects and problems of the Canadian economy. A variety of topics may be discussed, including the economic development of Canada, the structure of the current national and regional economies, industrial organization, factor market operation, income distribution, the role of international trade and capital flows, and the stability of the economy.
W.I. Gillespie.

• Economics 43.512S1
Canadian Economy II
Economic theory applied to the workings of the Canadian economy. Empirical estimation of various aspects of factor market operation, production, distribution and aggregate economy. Participants are expected to prepare and present papers for discussion.
E.G. Davis.

• Economics 43.515T2
History of Economic Thought
The crucial achievements in economic theory and doctrine in the nineteenth and twentieth centuries are studied. Special emphasis is given to the interrelationship between the social environment and economic thought—especially to the role of economics in the development of the national state and international institutions.
E.G. West.

• Economics 43.530T2
Industrial Policy
An examination of the theories pertaining to industrial organization and their application to particular industries in Canada and elsewhere by way of empirical studies. Attention is given to the service sector as well as the

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

manufacturing and resource sectors, and to international aspects of industrial organization. A range of public policies used to promote and restrict competition in terms of both conduct and performance are discussed, e.g., control of restrictive practices, public ownership, commercial policy and various aspects of industry regulation.
D.G. McFetridge.

• Economics 43.540T2
Public Finance
A discussion of the government's role in the economy with emphasis on the Canadian public sector. Topics include the theory of public expenditures and taxation, models of collective choice, redistribution, intergovernmental relations, benefit-cost analysis and stabilization policy.
W.P. Hettich.

• Economics 43.546F1
Economic Growth
An examination of modern theories of economic growth. Constraints of renewable and non-renewable resources. Trade-offs between economic growth and environmental decay. Problems of inter- and intragenerational income distribution.
K.A.J. Hay.

• Economics 43.555F1
The Economics of Development
An examination of some key problems of development in the "Third World", including theoretical analysis and policy formulation and evaluation. Topics considered may include some of the following: dualistic models of development; choice of production technique; income distribution; choice of organizational form; intersectoral resource allocation; etc.
Prerequisites: Economics 43.590 and 43.591 or equivalents.

• Economics 43.560T2
International Trade and Policy
An intensive examination of the theory of international trade. Emphasis is placed on the theoretical explanations of trading patterns, factor movements and commercial policy. Students may opt to pursue the theoretical material in a mathematical form. The attempts to verify and quantify the theory will be examined and possible rationales for Canadian policy positions and negotiated agreements investigated.
R. Ruffin.

• Economics 43.566T2
Monetary Theory and Policy
This course is designed to provide the analytical tools of monetary theory and policy. The effects of monetary change on economic activity, the foundations of monetary theory, and classical, Keynesian and modern monetary analyses are discussed. The policy implications of the "optimum quantity of money," various estimates of money supply and demand, difficulties of implementing policy in open and closed economies and in a growth context, are also examined.
M.D. Bordo and K.A.J. Hay.

• Economics 43.570T2
Comparative Economic Systems
An analysis of the structure and functioning of economic systems. Some discussion of the notion of an economic system and of the criteria used to evaluate the performance of systems.
R.L. Carson.

• Economics 43.575T2
Mathematical Economics
A synthesis of some important topics in economic theory, with almost exclusive use of mathematical models. Some of these are: general equilibrium of the firm and/or the household, and related matters; general equilibrium of exchange and production; stability of equilibrium; linear programming, games, and the theory of the firm; selected topics in economic dynamics; value theory; social welfare functions; optimizing techniques and public policy.
Prerequisite: Mathematics 69.201, Economics 43.200, 43.210 or equivalent.
May be taken by senior undergraduates, with permission of Chairman and instructor.
E. Wiens.

• Economics 43.580F1
Urban Analysis
An examination of the economic properties of urban areas. Attention will be focussed on

the macro-dynamics of urban development, together with the micro-statics of the equilibrium properties of the urban land market. The impact of public policy in Canada on urban areas will be assessed in the light of the formal analysis.
A. Maslove.

• Economics 43.581W1
Regional Analysis
Regional economic disparities in Canada, theories and public policy relating thereto. Consideration will be given to the concept of regions, location of industry and industrial structure and to growth determinants. Various aspects of policy designed to improve the fortunes of the less prosperous regions will be examined.
T.N. Brewis.

• Economics 43.585W1
Advanced Econometrics
Special topics in single equation estimation and linear multi-equation estimation. Analysis of errors; and multivariate analysis, including principal components, canonical correlation and factor analysis.
Prerequisites: Economics 43.485, 43.505 or equivalent.
S.B. Park.

• Economics 43.598T2
M.A. Tutorial

• Economics 43.599F3, W3, S3
M.A. Thesis

• Economics 43.600F1
Economic Theory I: Micro-Economics
Lectures and seminars on critical aspects of consumer behaviour, the theory of the firm, market structures, theory of income distribution, and welfare considerations. Emphasis will be placed on policy implications.
Prerequisites: Economics 43.501 and 43.503, or equivalents.
J.C. McManus.

• Economics 43.601F1
Economic Theory II: Macro-Economics
Lectures and seminars on critical aspects of consumption, investment, government expenditure, taxation, external economic equilibrium, money, prices and employment stabilisation and economic growth. Emphasis will be placed on policy implications.
Prerequisites: Economics 43.502 and 43.504 or equivalents.
G. Rich.

• Economics 43.602W1
Analysis of Micro-Economic Policy
An examination and evaluation of micro-economic policies. Various aspects of policy issues are analysed. These will be drawn from such areas as Industrial Economic Policy, Renewable and Non-Renewable Resources, Communication and Transportation, Regional Economic Policy, Social Economic Policy, and operations of the Labour Market.
E.G. Davis.

• Economics 43.603W1
Analysis of Macro-Economic Policy
An examination and evaluation of macro-economic policies. Policy issues are discussed, alternative solutions formulated and their outcomes considered. Attention will focus upon such areas as Incomes Policy, Taxation and Budgetary Policy, Central Bank operations, Exchange Rate manipulation, and Commercial Policy.
J.F. Chant.

• Economics 43.606F1
Economic Models and Policy Applications
Literature of micro- and macro-econometric models. Pitfalls in model building, model design, structure and estimation; simulation characteristics of quantitative models, forecasting, policy predictions, etc.
Prerequisite: Economics 43.505 or equivalent.
J.C.R. Rowley.

• Economics 43.608F1
Topics in Advanced Micro-Theory

• Economics 43.609W1
Topics in Advanced Macro-Theory

• Economics 43.611F1, W1, S1
Workshop in Economics Policy
Forums in which graduate students and faculty can work together on policy questions. Workshops will be held in the following fields: urban and regional economics; economic organization and development; money and trade; public economics; and quantitative methods.

Doctoral students are required to join two workshops and present a paper to one of these groups.

The courses listed below indicate the area in which members of the Department are prepared to supervise directed reading, research and seminars. Not all of the courses will necessarily be offered in any one year.

- Economics 43.630F1
Industrial Organization I
Prerequisite: Economics 43.530 or equivalent.

- Economics 43.631W1
Industrial Organization II
Prerequisite: Economics 43.630.

- Economics 43.640F1
Public Finance I: Advanced Taxation Theory
Prerequisite: Economics 43.540 or equivalent.

- Economics 43.641W1
Public Finance II: Advanced Expenditure Theory
Prerequisite: Economics 43.640.

- Economics 43.660F1
Theory of International Trade
Prerequisite: Economics 43.560 or equivalent.

- Economics 43.661W1
Monetary Theory
Prerequisite: Economics 43.566 or equivalent.

- Economics 43.662W1
Balance of Payments and International Monetary Theory
Prerequisite: Economics 43.660 or 43.661.

- Economics 43.680F1
Urban and Regional Economics I
Prerequisite: Economics 43.580 or equivalent.

- Economics 43.681W1
Urban and Regional Economics II
Prerequisite: Economics 43.581 or equivalent.

- Economics 43.696F1
Selected Advanced Topics
Prerequisite: Permission of Chairman.

- Economics 43.697W1
Selected Advanced Topics
Prerequisite: Permission of Chairman.

- Economics 43.699F, W, S
Ph.D. Thesis

The Department

Chairman of the Department: T.P. Wilkinson
Departmental Supervisor of Graduate Studies: J.P. Johnson, Jr.

The Department of Geography offers programs of study and research in Physical and Human Geography leading to the degree of Master of Arts. Inquiries are welcomed about inderdisciplinary topics and post-M.A. study that may be undertaken in co-operation with other departments of the University.

The program of study for each student is based on the interests of the individual. An Advisory Committee consisting of the student's research supervisor and at least two other members of the department is set up to monitor and provide guidance for the student's research. The department has excellent laboratory facilities for the rigorous study of near surface processes and the physics, chemistry and thermo-dynamics of earth materials. There is a large map library and a well-equipped cartography laboratory as well as a mini-computer/plotter/digitizer. These facilities are supported by a highly-qualified full-time staff in laboratory instrumentation, cartography and data processing. The location of the university in the nation's capital offers the student access to important resources such as the National Library, National Archives, and Statistics Canada.

Currently, the main areas of specialization in the Department are the following:

Physical Geography
Studies of natural processes close to earth's surface; climate-ground interaction; micrometeorology in frozen ground regions; the chemical, physical and thermodynamic properties of soils and sediments; hydrology and sedimentology of fluvial processes in glacial and periglacial environments. Current emphasis in investigations of geotechnical concern are cold region phenomena, soil water relations and stability of marine clays. (J.P. Johnson, M.W. Smith, J.K. Torrance, T.P. Wilkinson, P.J. Williams)

Cultural and Historical Geography
The effect of cultural attitudes and techniques on the evolution of human groups, their organization of earth's space and resources in past and present landscapes, cross-cultural studies focusing particularly on the role of political and religious authority and ideology in changing the physical environment, concepts of territory and territoriality; and perception of the environment and settlement history. (J. Clarke, D.B. Knight, G.C. Merrill, D.R.F. Taylor, P.E. Uren)

Urban and Economic Geography
Identification of basic spatial regularities in the socio-economic organization of human activity. Spatial decision-making and spatial dynamics as exemplified in the internal structure of urban places, industrial location, regional organization and characteristics of transport systems. (D. Bennett, D.M. Ray, J.E. Tunbridge, A.I. Wallace)

Rural and Resource Development
Identification of development processes in the rural milieu; the interplay of population, political, demographic, socio-economic variables with land resources and spatial factors. Frontier settlement, rural-urban evolution in developing countries, and recreational land use are of particular interest. (D.M. Anderson, D.P. Fitzgerald, D.R.F. Taylor, P.E. Uren)

Systematic interests of department members are applied to regions of special interest: Africa (Knight, Taylor); South East Asia (Fitzgerald); South West Pacific (Knight); Arctic and Subarctic (Fitzgerald, Smith, Johnson, Williams); Eastern Europe and U.S.S.R. (Uren), Canada (Anderson, Clarke, Wallace, Knight)

Qualifying Year Program

Applicants with exceptional promise who have a general (pass) Bachelor's degree, or who have substantially less than the Honours B.A. in Geography may be admitted to a Qualifying Year program. To be considered for admission into the Master's program, Qualifying Year students must attain at least an overall high second-class standing in their Qualifying Year Geography courses. The general section of

this Calendar provides details about the regulations governing the Qualifying Year.

Master of Arts

Admission Requirements

The normal requirement for admission into the Master's program is an Honours B.A. or B.Sc. in Geography with at least a high second-class standing. Applicants who have taken their undergraduate degree in the physical or natural sciences or engineering as well as in physical geography will be considered if their research interest coincides with those of the department. Applicants in human geography may be accepted from related fields, if their proposed research is closely related to faculty research experience. Students with academic deficiencies may be required to take additional courses.

Program Requirements

The Master's program usually consists of three full courses (or the equivalent) selected in consultation with the Department, and a thesis (equivalent to two full courses) which must be defended at an oral examination. Normally demonstration of a reading knowledge of a second language appropriate to a student's research interest is required. The M.A. in Geography takes a minimum of 12 months and frequently will require an additional three to six months.

Graduate Courses*

In addition to the selection of courses offered by the Department, graduate students in Geography are encouraged to consider, in partial fulfillment of their degree requirements, appropriate courses offered in such disciplines as Biology, Chemistry, Economics, Engineering, Geology, History, International Affairs, Physics, Political Science and Sociology.

Courses at the University of Ottawa may also be taken for credit in a Carleton M.A. program. Permission of departments in both universities is required.

The prerequisite for all courses in the Department is permission of the supervisor of graduate studies and the instructor.

The following courses will normally be offered annually.

• Geography 45.500F1
Graduate Research Seminar
The application of scientific principles of investigation to contemporary research in geography. This course is suitable for students regardless of specialization.
D. Bennett.

• Geography 45.517F1, W1, S1
Field Study and Methodological Research
Field acquisition and analysis of geographic material. Supervised field observations and methodology. Individual or group basis, by special arrangement.
Coordinator: J.P. Johnson.

• Geography 45.520F1
Geographical Aspects of Development
The problems facing developing nations today with emphasis on their spatial aspects. Examples will be drawn from African nations.
(Also listed as International Affairs 46.505T2)
D.R.F. Taylor.

• Geography 45.521W1
Geographical Aspects of Development
The problems facing the developing nations of Asia, especially South East Asia, with special emphasis on rural and population problems.
D.P. Fitzgerald.

• Geography 45.530F1
Research Theories and Methods in Physical Geography
Basic scientific procedures relevant to physical geography research at Carleton; interrelationship of research projects; scientific communication, research applications.
This seminar course is recommended for all graduate students in physical geography.
Coordinator: M.W. Smith.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

• Geography 45.531W1
Laboratory Instrumentation
The use of standard analytical equipment, and the design, construction and operation of apparatus for investigation of physical properties of earth materials. For students planning to carry out thesis research involving complex instrumentation.
Coordinator: P.J. Williams.

• Geography 45.532F1
Experimental Geomorphology
Instrumental techniques for investigation of hydrological and thermal processes near the earth's surface; analysis of laboratory and field procedures.
P.J. Williams.

• Geography 45.533W1
Periglacial Geomorphology
Permafrost, its distribution and significance; seasonal ground freezing; ground thermal regime; physical and thermodynamic properties of freezing and thawing soils; terrain features ascribable to frost action; solifluction and patterned ground.
P.J. Williams.

• Geography 45.535T2
Glaciology
The flow and temperature regimes of glaciers and ice sheets; classification and growth of lake and river ice; the behavior of ice under load; the diagenesis of snow and melt processes.
(Also listed as Geology 67.545)
A.D. Stanley and R.O. Ramseier.

• Geography 45.536W1
Glacial Geomorphology
Formation and analysis of glacial landforms.
J.P. Johnson.

• Geography 45.540F1
Explorations in Cultural and Historical Geography
Man's creative capacities in historical perspective emphasizing organization of space and interrelationship with the physical environment from the viewpoint of culture. Special focus on territory and territoriality.
D.B. Knight.

• Geography 45.543W1
Selected Concepts in Cultural Geography
G.C. Merrill.

• Geography 45.545W1
Problems in Historical Geography
Philosophical and methodological approaches in geography, history, and historical geography, emphasizing the use of primary documents, model building and statistical methods as they relate to historical geography of Canada.
J. Clarke.

• Geography 45.550F1, W1
Spatial Dynamics of Urban and Regional Systems
Research paradigms and geographic models. The spatial consequences of individual and corporate decision-making, and public policy constraints in advanced industrial economies.
D. Bennett and D.M. Ray.

• Geography 45.571F1
Selected Studies in the Human Geography of Arctic and Subarctic Lands
Social and economic development problems of the Arctic and Subarctic in Canada and the U.S.S.R., with an emphasis on the Soviet Subarctic.
D.P. Fitzgerald.

• Geography 45.572W1
Problems in Canadian Resource Development
Energy resources and urban-rural land resource conflict. Arctic environmental problems, forestry and continental shelf resources development.
D.M. Anderson.

• Geography 45.579F1
Research and Development in Recreational Geography
National and international trends and research in recreational demand, travel, land utilization and planning.
D.M. Anderson and G.D. Taylor.

• Geography 45.590F1, W1, S1
Graduate Tutorial
Tutorial, directed reading or research; offered on an individual basis, to meet specific program needs; may be taken in one of the areas of specialization of the department.
Coordinator: J.P. Johnson.

• Geography 45.599F4, W4, S4
M.A. Thesis
Thesis supervision will be given in all areas of specialization of the department, as listed in the calendar section identifying departmental specializations.
Coordinator: J.P. Johnson.

Courses not offered in 1976-77:
45.580 Spatial Information Systems and Computer Cartography
45.534 Aspects of Clay Mineralogy and Soil Chemistry

Norman Paterson School of International Affairs

The School

Director: P.E. Uren

The Norman Paterson School of International Affairs, established in 1965 with the generous support of the Honourable Norman M. Paterson, offers a program of studies leading to the M.A. degree.

The program focuses on four themes: International Integration; Political, Economic and Social Development; Canada's International Policies; and Conflict Analysis. Attention is paid to the role of international institutions, the foreign policies of other countries, and to selected regional studies. The School maintains close cooperation with the Institute of Soviet and East European Studies, and with committees designed to encourage and coordinate faculty and student interests in Africa, Asia and Latin America. The chairmen of these committees are: on Africa, Professor D.R.F. Taylor (Department of Geography); on Asia, Professor R. Bedeski (Department of Political Science); and on Latin America, Professor A.R.M. Ritter (Department of Economics).

Qualifying Year Program

The Qualifying Year program is designed to enable students with at least second-class standing but with inadequate background in the disciplines relevant to the M.A. program to make up deficiencies. Candidates with a general (pass) Bachelor's degree in a discipline closely related to International Affairs, and those with an Honours bachelor's degree in an unrelated discipline, may be required to take three to five Qualifying Year courses before being eligible to enter the Master's program.

Students in the Qualifying Year are encouraged to select a core theme. They may also wish to select an area emphasis and to take courses that will enable them, in the M.A. year, to engage in specialized study in the problems of a region having particular relevance to the core theme they have elected. Students should also take appropriate courses in order to prepare them to fulfill the language requirement of the M.A. program.

Program Requirements

International Integration
Two courses are recommended: Economics 43.360 or Economics 43.361 (half-courses), and Political Science 47.360 and 47.361 (half-courses) or 47.460. Also recommended are Sociology 53.245 and 246 and at least two courses relating to a region where the nature and effects of integration may be studied, for example, courses bearing on the European Economic Community, Comecon, or an integration process in lesser developed areas.

Political, Economic and Social Development
The following courses will normally be required: Economics 43.360 or 43.361 and 43.363 (half-courses), and at least one course in Geography, Political Science or Sociology and Anthropology relevant to this theme. Particularly recommended are courses on one of the developing regions: Geography 45.330 or 45.380 and 45.381 (half-courses), Political Science 47.310 or 47.315, Anthropology 54.230 and 54.362, and Sociology 53.360.

Canada's International Policies
The following courses are recommended: Canadian History (for example, History 24.336, 24.337 and 24.433); Canada-United States Relations (History 24.334); The Economic Development of Canada (Economics 43.325); Canadian Government and Politics (for example, Political Science 47.335 and 47.340, and 47.336, 47.366 and 47.401 (half courses); Economics 43.360, 43.361 or 43.380 (half-courses); and Political Science 47.361 and 47.365 (half-courses) or 47.460.

Conflict Analysis
The following courses are recommended: History 24.380, 24.480 or 24.481; Political Science 47.361 and 47.365 (half-courses) and 47.270 and 47.460; and Sociology 53.300, 53.340 or 53.400. Also recommended are courses dealing with other approaches to conflict or with regions in which the student may wish to apply conflict theory.

Master of Arts

Admission Requirements

The normal requirement for admission into the Master's program is an Honours bachelor's degree in a discipline related to international affairs, with at least second-class standing.

Candidates who lack the required background in international affairs will be expected to take a maximum of two additional courses.

Program Requirements

The normal program requirements for M.A. students in international affairs who elect to write a thesis or research essay are:

- one interdisciplinary core seminar selected from the following:

International Affairs
46.500 International Integration
46.505 Issues in Development
46.510 Canada's International Policies
46.515 Conflict Analysis

Each of these core seminars is valued at one credit (one full course);
- two other approved courses (or the equivalent) in International Affairs or related disciplines, normally at the graduate level, if a student elects to write a thesis;
- three other approved courses (or the equivalent) in International Affairs or related disciplines, normally at the graduate level, if a student elects to write a research essay;
- a thesis (valued at two credits) or a research essay (valued at one credit) involving original research on an approved subject in the field of International Affairs;
- an ability to read a second major international language or a language vital to a student's major research interest;
- an oral comprehensive examination primarily on the thesis or research essay and core seminar to determine the candidate's ability to relate various disciplines to the study of International Affairs.

For students who elect a five-course program without writing a thesis or research essay:
- one interdisciplinary core seminar selected as above;
- four other approved courses selected as above;
- language requirements as above;
- a written and oral comprehensive examination on three fields to determine the candidate's ability to integrate the course work and relate various disciplines to the study of international affairs.

Academic Standing

A grade of B– or better must be obtained in each course counted for credit towards the Master's degree.

Graduate Courses*

- International Affairs 46.500T2
International Integration
The study of political, economic and social integration of nations, with particular emphasis on Western Europe.
T.N. Brewis, B.A. McFarlane, D. Puchala and others.

- International Affairs 46.505T2
Issues in Development
The study of the principles and problems of development in the less industrially advanced regions of the world.
J. Nellis, A.R.M. Ritter and D.R.F. Taylor.

- International Affairs 46.510T2
Canada's International Policies
An examination of the development of Canada's policies in international affairs since 1945, using case studies to analyse the interests and objectives involved in the formulation of those policies.
A.F.W. Plumptre, B.W. Tomlin and others.

- International Affairs 46.515T2
Conflict Analysis
A study of contemporary theories of inter-

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

national conflict, war and peace.
M.G. Fry, H. von Riekhoff and H. Tajfel.

• International Affairs 46.520F1
Studies in Strategy and Security
Selected topics in strategic theory and practice.
C. Gray.

• International Affairs 46.521W1
Studies in Strategy and Security
Selected topics in strategic theory and practice.
P. Nailor.

• International Affairs 46.525F1
International Monetary Institutions
G. Rich.

• International Affairs 46.535F1
Integration in Eastern Europe
R. Selucky and P.E. Uren.

• International Affairs 46.545F1
Foreign Policies and Conflict in Africa
D.G. Anglin and A. Smith.

• International Affairs 46.555F1
Development Problems in South and Southeast Asia
E.L. Tepper.

• International Affairs 46.565F1
The Economics and Politics of the Oil Question
H. Barkai.

• International Affairs 46.526W1
Integration in Developing Countries
L.K. Mytelka.

• International Affairs 46.536W1
Problems in Middle East Affairs

• International Affairs 46.546W1
Development Problems in Latin America
A.R.M. Ritter.

• International Affairs 46.556W1
Problems in International Law
J.G. Neuspiel and others.

• International Affairs 46.566W1
Topics in East-West Economic Relations
C.H. McMillan.

• International Affairs 46.530T2
The International Enterprise
Economic and political developments in the fields of international trade and investment as they relate to the operations of international enterprises. The impact of international enterprises on host countries and the policy response of host governments, with special attention devoted to the Canadian situation.
I.A. Litvak and C.J. Maule.

• International Affairs 46.531F1
Science, Technology and International Affairs - Analytical Approaches
(To be taken by all students who intend to complete either I.A. 46.532 or I.A. 46.533 in the winter term.)
S. Langdon, J. Lukasiewicz, B.A. McFarlane, L.K. Mytelka and others.

• International Affairs 46.532W1
Science, Technology and International Affairs - the Developed Countries
J. Lukasiewicz and B.A. McFarlane.

• International Affairs 46.533W1
Science, Technology and International Affairs - the Less-Developed Countries
S. Langdon, L.K. Mytelka and F. Sagasti.

• International Affairs 46.591F1, W1, S1
Tutorials in International Affairs
To be chosen in consultation with the School.

• International Affairs 46.598F1, W1, S1
Research Essay

• International Affairs 46.599F1, W1, S1
M.A. Thesis

Selection of Courses

In addition to the graduate courses offered by the School, a selection of courses given in various departments, schools and institutes is open to Qualifying Year and Master's students in International Affairs. The departments, schools and institutes are Anthropology, Economics, Engineering, Geography, History, Law, Political Science, Sociology, Comparative Literature and Public Administration.

Students should consult the undergraduate and graduate calendar entries of these departments, schools and institutes to assist their course selection.

The Department

Chairman of the Department: K.G. McShane
Director of the Jurisprudence Centre: P.J. Fitzgerald

Although the Department of Law does not offer a program of studies leading to the M.A. degree, it actively participates in such interdisciplinary graduate programs as those offered by the Norman Paterson School of International Affairs, the Institute of Canadian Studies and the School of Public Administration. Members of the Department also supervise graduate theses and research essays and provide tutorials at the graduate level dealing with the legal aspects of other disciplines.

The Jurisprudence Centre, established by the Department in 1974, is a forum for the advanced interdisciplinary study of problems related to law, law reform, and politics.

The Department of Law offers two courses at the graduate level.

Graduate Courses*

• Law 51.555T2
Administrative Law II
Legal control of administrative action. Review and appeal; judicial and non-judicial controls. Statutory reforms. Approaches to control outside Canada. Research paper.
D.W. Elliott.

• Law 51.567W1
Advanced International Legal Problems
In 1976-77 this seminar course will consist of an in-depth study of the Law of Treaties. (This course is also offered in the School of International Affairs as 46.556.)

Prerequisite: Law 51.463 or equivalent or permission of the Department.
J.G. Neuspiel.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Department of Political Science

The Department

Chairman of the Department: R.J. Jackson
Departmental Supervisor of Graduate Studies: R.J. Van Loon

The Department offers programs leading to the M.A. and Ph.D. degrees. Specialized graduate study and research may be undertaken in the fields of political theory, Canadian government and politics, comparative government and politics, international relations, and public administration. Within these fields, students may select more specialized areas of concentration, such as classical, medieval and modern, or analytic and empirical theory, comparative government and politics of a particular area or group of countries such as Africa, Eastern Europe, or South and East Asia where the Department has developed particular strength and resource materials.

Ottawa provides a wealth of resources, both in personnel and in research material for the student of government, politics, public administration, and international relations. Carleton has specialized schools and institutes in interdisciplinary study in public administration, Canadian studies, international affairs, and Soviet and East European studies. In addition to the university facilities, Ottawa offers the graduate student in political science a host of study and research opportunities unparalleled in Canada. The Public Archives, the National Library, the Library of Parliament, the Supreme Court Library, the National Museums, and Statistics Canada are all located in Ottawa. The headquarters of all government departments, most federal government agencies, and a multitude of national organizations and trade associations are located in Ottawa; many maintain specialized libraries. Some of the embassies and diplomatic missions located in Ottawa maintain specialized libraries and offer access to documents and other research materials.

Qualifying Year Program

Applicants who have a general (pass) B.A. in Political Science, with high standing (grade point average of at least 7.0) may be considered for admission to a Qualifying Year program. Candidates who complete the Qualifying Year with at least B standing (grade point average of 8.0, with no grade less than B–) may proceed to the Master's program the following year. A candidate may, with the approval of the departmental Graduate Studies Committee, be allowed a grade of C+ or C in one full course or each of two half-courses in meeting the required 8.0 average.

Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Arts

Admission Requirements

The normal requirement for admission to the Master's program is an Honours B.A. (or the equivalent) in Political Science, with at least B standing. This will normally mean a Carleton grade point average of 8.0 taking into account both transcript and letters of reference.

Honours graduates in fields other than Political Science will be considered on the basis of their academic background and standing. Those with deficiencies may be required to take additional courses or to register in the Qualifying Year program.

Program Requirements

All Master's candidates will enroll in an approved number of courses in Political Science including political theory and research methodology if not already taken. No more than two of these courses may be taken at the 400 level.

Each candidate, in consultation with the Department, will select and follow one of the following three optional program patterns:

- five full courses (or the equivalent) in Political Science;
- four full courses (or the equivalent) in Political Science, and a research essay on a topic

related to one of the courses;
- three full courses (or the equivalent) in Political Science and a research thesis, equivalent to two full courses, in an approved field.

All Master's candidates in Political Science must also undertake a comprehensive oral examination on approved major and allied fields. Details of this examination are outlined below under Comprehensive Examination.

All candidates must also demonstrate a reading knowledge of French. Students from abroad, whose mother tongue is other than English or students whose research interests require another language, may obtain permission from the departmental Graduate Studies Committee to substitute this language for French. Language tests are conducted twice a year, in October and February.

A supervisor will be assigned to each candidate to advise and assist in the preparation for the comprehensive and language examinations.

Comprehensive Examinations

All Master's candidates in Political Science must successfully pass an oral comprehensive examination in a major field of concentration chosen from the following list:
- Political Theory
- Canadian Government and Politics
- Comparative Government and Politics
- International Relations
- Public Administration

The comprehensive examination will cover not only depth of knowledge of the literature in the field, but the relation of theory and research in that field of Political Science to an allied field in Political Science or, with the approval of the departmental Graduate Studies Committee, a discipline related to Political Science. To prepare for the comprehensive examination, the student will pursue an approved program of courses related to his chosen field.

Academic Standing

All Master's candidates must obtain at least B standing (grade point average of 8.0). One grade of C+ may be allowed.

Doctor of Philosophy

The Doctoral program in Political Science may be undertaken only on a full-time basis.

Admission Requirements

The normal requirement for admission to the Ph.D. program is a Master's degree (or its equivalent) in Political Science, Public Administration, or International Affairs, with at least high second-class standing. This will normally mean a Carleton equivalent grade point average of 9.5 taking into account both transcript and letters of reference.

Program Requirements

The normal program requirements for Ph.D. candidates are outlined in the general regulations sections of this Calendar.

All students are required to have or acquire an adequate basic knowledge of political theory, research methodology, and Canadian government, regardless of their field of specialization, and an acquaintance with disciplines closely related to Political Science. They will also be expected to undertake further work in statistics if statistical proficiency is needed for the preparation of the thesis.

The specific program requirements for Ph.D. candidates in Political Science are the following:
- At least three graduate full courses (or the equivalent), one of which must be in political theory or methodology; a grade point average of at least 9.0 must be obtained in these courses before proceeding to the comprehensive examinations. Additional courses may be required for candidates whose background or standing is deficient.
- Political Science 47.690 and 47.695 (Ph.D. Tutorials);
- proficiency in languages and/or research skills, as outlined below under Language and Research Skill Requirement;
- comprehensive examinations as outlined below under Comprehensive Examinations;
- A thesis, written in English or French, which must be defended in English at an oral examination; this examination may include material related to the general field of the thesis.

The completion of the Ph.D. program will normally require at least two years of full-time study beyond the Master's degree.

A supervisor and two other advisers will be assigned to each Ph.D. candidate to advise him on his studies. The student's entire program must be approved by the Department.

Language and Research Skill Requirement

All Ph.D. candidates must demonstrate an ability to use two research skills appropriate to their program, one of which must be a language other than English.

Candidates whose major field deals with Canada, or whose thesis deals mainly with Canada, must demonstrate an ability to read and translate French easily as one of their skill requirements.

All other candidates must demonstrate an ability to read and translate easily a language appropriate to their program.

The second skill requirement may be fulfilled in one of the following ways:

- a demonstrated ability to read and translate easily a second language;
- an oral knowledge of a language sufficient to conduct interviews in the language;
- satisfactory completion (B– or better) of Political Science 47.570, Advanced Research Methods;
- credit work in an approved political science methodology workshop or colloquium.

The research skill requirement must be satisfied before the thesis proposal defence.

Comprehensive Examinations

All Ph.D. candidates must undertake the following examinations:

- a written examination in two approved fields, covering general knowledge of the field and two approved areas of specialization in each field. An oral examination on the written material may be given at the discretion of the examining committee;
- a final oral comprehensive examination integrating the two fields.

The comprehensive examinations will normally be given in September-October, January-February and May-June, and will normally be completed by the beginning of the seventh term of registration. Candidates will be expected to successfully complete these examinations before beginning the thesis. The fields of study for the Ph.D. examinations are to be chosen from the following list.

Political Theory

A general knowledge of the main outlines and significant themes and problems of political philosophy and thought with emphasis on one or two of the following: classical (mainly Greek and Roman); modern (Machiavelli through the 19th century); contemporary (20th century); Canadian and American political thought and its immediate European background; current theories and approaches to political analysis; methodology and theory construction.

Canadian Government and Politics

A general knowledge of Canadian political ideas, institutions and processes, with emphasis on one or two of the following: federalism; the parliamentary system; political behavior (with specialization in two of the following—political parties, interest groups, voting and elections, political culture and political socialization); provincial government and politics; local government and politics; and public administration.

Comparative Government and Politics

A general knowledge of the theories and methodology of comparative politics with emphasis on one or two sub-fields from the following two lists:

Countries or areas: Western Europe; U.S.S.R. and/or Eastern Europe; United States; Africa; or an approved combination of countries or areas.

Topics or themes: political development and integration; political stability and change; federalism; legislatures; local government and politics; multiculturalism and the politics of ethnicity; political parties and interest groups; public opinion and voting behavior; policy analysis.

International Relations

A general knowledge of international theory, international institutions and world history since 1914, with emphasis on one or two of the following: analytical international theory; foreign policies of particular states; interna-

tional institutions and law; international integration; conflict resolution and peace research; strategic studies.

Public Administration
A general knowledge of theory, including comparative theory, and of practice in Canada, Britain and the United States, with emphasis on one or two of the following topics: theories of administration and organization; Canadian administration (including some knowledge of provincial and municipal administration); comparative public administration (with reference to either developing or developed countries or an approved combination of countries); administrative responsibility (including judicial controls).

Candidates may choose an area of specialization in a discipline related to Political Science, with the approval of the departmental Graduate Studies Committee.

Selection of Courses

Within the scope of the regulations, the following undergraduate courses (fully described in the Undergraduate Calendar) may be taken by graduate students.

Political Science
47.400 Topics in Canadian Government and Politics
47.401 Policy Making in Canada
47.402 Policy Seminar
47.403 Politics and the Media
47.404 Interest Groups in Canadian Politics
47.405 Federalism
47.406 Legislative Process in Canada
47.409 French Canadian Politics
47.410 Politics of Developed Societies
47.411 Politics of Developing Societies
47.420 President and Congress in the United States
47.421 Parties and Pressure Groups in the United States
47.422 American Constitutionalism
47.430 Modern Political Thought
47.431 Marxist Thought
47.432 Contemporary Communist Thought
47.435 The Conflict of Ideas in Contemporary Society
47.446 Theories of Public Administration
47.460 Theories of International Relations
47.461 Soviet Foreign Policy
47.462 International Communist Movement
47.466 American Foreign Policy
47.470 Political Research Design and Data Analysis
47.482 International Politics of Africa
47.483 Foreign Policies of Major East Asian Powers

Except where an M.A. student is permitted to take an allied field in another discipline, a graduate student may take no more than one course in another department, school or institute, in fulfillment of the M.A. or Ph.D. requirements.

Graduate Courses*

• Political Science 47.500F1
Problems of Canadian Local Government and Politics
A research seminar on selected problems.
H.B. Mayo.

• Political Science 47.501W1
Problems of Canadian Provincial Government and Politics
A research seminar on selected problems.
Prerequisite: Political Science 47.200 or permission of instructor.
J.H. Pammett.

• Political Science 47.502W1
Comparative Local Government
A seminar on the systems of local government in the United States, Britain and France (which have provided prototypes for many other countries), and systems in other countries, chosen according to the interests of the students.
D.C. Rowat.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

• Political Science 47.505T2
Comparative Government
A research seminar dealing in the fall term with theories, methods and problems of comparison, and in the winter term with particular themes.
R.J. Jackson and L.V. Panitch.

• Political Science 47.506F1
Problems of Canadian Government and Politics I
A research seminar on selected problems.
M.S. Whittington.

• Political Science 47.507W1
Problems of Canadian Government and Politics II
A research seminar on selected problems.
David Lewis.

• Political Science 47.510T2
The Political Process in Canada
An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups and political leadership in Canada.
J. Jenson and M.S. Whittington.

• Political Science 47.514F1
Comparative Communist Politics, Theory and Practice
Examination and analysis of basic models of communist political systems, with emphasis on problems of systemic change and adaptation (inclusive of Soviet, East European and Asian systems and Cuba).
Prerequisites: Political Science 47.320 and 47.215 or 47.312, or permission of instructor.
T. Rakowska-Harmstone.

• Political Science 47.515W1
Comparative Communist Politics, Selected Aspects
Examination and analysis of selected aspects of communist political processes, such as: integration; elite formation, leadership and succession; decision-making. The emphasis will change from year to year.
Prerequisite: Political Science 47.514 or permission of instructor.
T. Rakowska-Harmstone.

• Political Science 47.516W1
Selected Problems in Soviet Politics
A seminar on selected aspects of the Soviet political system with special attention to the interrelationship between politics, culture and society in the U.S.S.R.
Prerequisites: Political Science 47.100, 47.320 and 47.432 or permission of instructor.
B.R. Bociurkiw.

• Political Science 47.517F1
Selected Problems in African Politics
A political economy approach will be taken in this seminar stressing the relationship of dependence, underdevelopment, participation and class formation to the decision-making process in selected countries.
L.K. Mytelka.

• Political Science 47.520F1
Nationalism
A seminar on the historical and comparative study of nationalism, with emphasis on its role in the promotion of political change.
E.L. Tepper.

• Political Science 47.521W1
Multiculturalism
A research seminar on political aspects of multiculturalism. Primary emphasis will be on linguistic and cultural pluralism in developed societies, including Canada.
K.D. McRae.

• Political Science 47.526W1
Selected Problems in American Government
A research seminar on topics such as the distribution of power; business and politics; political corruption; civil rights and minority politics; executive accountability; civil-military relations; and the urban crisis.
Prerequisites: Political Science 47.322; and one of 47.420, 47.421, 47.422, or permission of the instructor.
J. Alexander.

• Political Science 47.530T2
Political Theory
An intensive examination (a) of the core questions and themes in the classical, medieval and modern phases of political philosophy, considered in their historical setting, and (b) the major concepts and approaches used in contemporary political analysis.
H.B. Mayo, W.A. Mullins and R. Selucky.

• Political Science 47.532F1
Modern Political Culture and Ideology
A philosophical analysis of political culture, its principal forms, and their differential implications for politics, with emphasis on the leading modern ideologies.
W.A. Mullins.

• Political Science 47.533W1
Selected Topics in Political Theory
The content of this seminar may change from year to year. Work will centre largely upon problems in the theory of democracy.
H.B. Mayo.

• Political Science 47.535T2
The Canadian and American Political Traditions
A seminar on the interpretation of the American, English Canadian and French Canadian political traditions, with emphasis on their comparative development.
K.D. McRae.

• Political Science 47.540T2
Problems in Canadian Public Administration
A seminar on selected issues and problems.
Prerequisite: Political Science 47.340 or permission of instructor.
R.J. Van Loon.

• Political Science 47.545W1
Public Administration in Developing Countries
A seminar on the literature and characteristics of development administration; comparison by region, country, and topic, with emphasis on the English-speaking developing countries.
Prerequisite: Political Science 47.466 or permission of instructor.
J.R. Nellis.

• Political Science 47.547T2
Decision Theories and Policy Studies
A research seminar on advanced concepts in analytical and behavioural decision theories, comparison of economic and philosophical ideas of decision-making, cybernetics, management tools, policy models and processes and policy sciences.
Prerequisite: Political Science 47.446, or permission of instructor.
V. Subramaniam.

• Political Science 47.550T2
Problems in Western European Politics
This course will deal intensively with politics in Britain, France, Germany, Italy, and selected minor European powers both democratic and authoritarian.
Prerequisites: At least one course beyond Political Science 47.100 on democratic or authoritarian governments, and either a comparative theory or a methodology course.
R.J. Jackson.

• Political Science 47.560T2
Theory and Research in International Politics
An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.
Prerequisite: Political Science 47.460 or permission of instructor.
B.W. Tomlin and H. von Riekhoff.

• Political Science 47.561F1
Canadian Foreign Policy
A research seminar on the formulation of contemporary Canadian foreign policy and on Canadian external behaviour.
Prerequisite: Political Science 47.366 or permission of instructor.
P.V. Lyon.

• Political Science 47.570T2
Advanced Research Methods
A seminar in research design, data generation techniques and data analysis. Modules include research design (required) and a selection from survey research, aggregate data analysis, content analysis, roll-call analysis, formal analysis, measurement and scaling techniques.
Prerequisite: Political Science 47.470 or equivalent.
N.H. Chi, K. Hart and C.J. Winn.

• Political Science 47.581W1
Foreign Policies of African States
A research seminar on the foreign policy behaviour of African states.
D.G. Anglin.

• Political Science 47.585W1
Foreign Policy Analysis
A research seminar dealing with selected problems in the study of foreign policy formulations and outcomes.
Prerequisite: Political Science 47.460 or

permission of instructor.
B.W. Tomlin.

• Political Science 47.587F1
Analysis of International Organization
A research seminar on process and change in contemporary forms of international organization.
Prerequisite: Political Science 47.360 or permission of instructor.

• Political Science 47.590T2
Tutorial in a Selected Field
Tutorials or reading courses on selected topics may be arranged with the permission of the Chairman and agreement of instructor.

• Political Science 47.591F1, W1, S1
Tutorial in a Selected Field
Tutorials or reading courses on selected topics may be arranged with the permission of the Chairman and agreement of instructor.

• Political Science 47.598F2, W2, S2
Research Essay
Tutorial for students who write a research essay rather than a thesis.

• Political Science 47.599F4, W4, S4
M.A. Thesis

• Political Science 47.690T2, 47.695T2
Ph.D. Tutorials
Ph.D. tutorials specifically designed as intensive preparation for the field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examination.

• Political Science 47.691T1, 47.692T1
Ph.D. Tutorials (half-courses)
Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examinations. (Registration limited to students who entered the Ph.D. program prior to 1976-77.)

• Political Science 47.699F10, W10, S10
Ph.D. Thesis

Courses not offered in 1976-77:
47.504 Urban Politics
47.525 The American Polity
47.544 Public Administration in Developed Western Countries
47.586 Strategy
47.589 Advanced International Relations Theory

The Department

Chairman of the Department: M.E. Marshall
Departmental Supervisor of Graduate Studies: H. Anisman

The Department offers opportunities for advanced study and research in experimental psychology and its history. Clinical and applied programs are not available.

Laboratory facilities for research in physiological psychology and learning include vivaria and histology labs for small mammals including cats, rats, and mice, as well as avians. Laboratories are equipped for monitoring various physiological and neurochemical activities, and for evaluating both appetitive and aversively motivated behaviors. Laboratories for human experimentation include equipment for the evaluation of human learning and memory, eyemovement camera, a six-channel tachistoscope and an anechoic chamber. In both human and animal laboratories on-line computer systems (for example PDP-83) are employed.

Observation rooms, equipped with both auditory and visual instrumentation, are available for studies in developmental and social psychology.

A nursery school on the premises, directed by the Department, provides an opportunity for studying the behavior of young children and serves as a pool of experimental subjects.

Candidates will be accepted for graduate studies in psychology only if they are prepared to register for full-time study. Part-time enrollment is permitted only when the amount of work involved in the completion of the thesis does not justify full-time classification.

All graduate students in psychology are expected to conduct research of interest to them during each year of graduate studies. This requirement may be satisfied by independent research, serving as a research assistant, or by doing pilot or thesis research.

Each term, the candidate's adviser submits a written critique of research progress, along with a letter grade, and these become part of the candidate's permanent record. (Qualifying Year students are evaluated at the end of the first 12 months). In addition to research activity, candidates may be required to serve as teaching assistants.

Depending on his field of concentration, a candidate may be required to demonstrate an ability to read with understanding relevant technical material in a foreign language and/or to give satisfactory evidence of competence in such areas as computer techniques, electronic instrumentation, psychometrics, sampling procedures, or surgical techniques.

All students are required to take a basic graduate course in quantitative methods (Psychology 49.545). However, successful completion of a qualifying open-book examination which encompasses the material covered in the course 49.545 waives the requirement.

The Department may recommend that a graduate student be asked to withdraw from the program at any time if his course and/or research performance is unsatisfactory.

Qualifying Year Program

Occasionally, candidates with exceptional promise who offer less than Honours B.A. status may be admitted to a Qualifying Year program, approved by the Graduate Studies Committee, and designed to prepare them for Master's study. A minimum grade of B– must be obtained in each Qualifying Year course, and candidates may be required to complete satisfactorily the equivalent of an Honours B.A. thesis.

Master of Arts

Admission Requirements

The normal requirement for admission into the Master's program is an Ontario Honours B.A. with second-class standing (or its equivalent) with credit in the following areas: statistics and design of experiments; experimental psychology; learning or motivation; physiology and/or comparative psychology; history and/or systems; and two or three additional courses in psychology.

Candidates with particular course deficiencies may be required to register in additional courses at Carleton.

Scores on the Graduate Record Examination (Aptitude and Advanced) are required at the time of application.

Program Requirements

The Master's program usually consists of three full courses (or the equivalent), of which at least two must be at the graduate level (numbered 500 or higher), and a thesis (equivalent to two full courses) which must be defended at an oral examination.

Academic Standing

A grade of B– or better is required in each of the five courses counted for credit towards the M.A. degree.

Doctor of Philosophy

Admission Requirements

The requirements for admission to doctoral programs are outlined in the general regulations section of this calendar.

Applicants should note that of the B.A., M.A., and Ph.D. degrees in Psychology, only two may ordinarily be taken at Carleton University.

Program Requirements

The minimum program requirements for the Ph.D. degree in Psychology are as follows:

- ten full course credits; a minimum grade of B– must be obtained in each course.
- a thesis, equivalent to four or five of the required ten full course credits;
- a major area of specialization must be selected in which not less than six nor more than seven and a half full course credits (including the thesis) may be offered in fulfillment of the ten-course requirement.

Comprehensive Examinations

All Ph.D. candidates are required to pass written and oral examinations in their area of specialization. Three optional forms for the written comprehensive are: seven short essays, two major essays, or one major essay and one research grant proposal.

The oral comprehensive examination will be undertaken not less than one week and not more than three weeks after the written section. The purpose of the oral is to give the student an opportunity to expand on the answers and solutions submitted in the written examination.

Graduate Courses*

- Psychology 49.500F1
Systems of Psychology
Historical research methods on the study of psychological movements and problems of the late 19th and early 20th centuries.
May be repeated for credit.
(Open with permission to advanced undergraduates)

- Psychology 49.501W1
Problems in the History of Psychology
A study of one or more selected topics in the history of man's attempt to understand his own nature.
May be repeated for credit.
(Open with permission to advanced undergraduates)

- Psychology 49.510F1
Research Methods in Social Psychology I
Experience with research and data analysis techniques of particular relevance for social psychology, such as sampling, attitude scaling, and measurement. Normally required of students writing a thesis in social psychology.

- Psychology 49.511W1
Research Methods in Social Psychology II
Current ethical and methodological issues in social psychological research, such as experimental effects, deception, and subject variables. Normally required of students writing a thesis in social psychology.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

• Psychology 49.523F1
Seminar in Physiological Psychology I
Selected classical and contemporary issues in physiological psychology, with emphasis on perceptual and motor processes. Normally required of students writing a thesis in physiological psychology.

• Psychology 49.524W1
Seminar in Physiological Psychology II
Selected classical and contemporary issues in physiological psychology, with emphasis on motivation, emotion and learning. Normally required of students writing a thesis in physiological psychology.

• Psychology 49.530W1
Perceptual Processes
Theoretical and empirical issues and implications of the area of perception, with attention to psychophysics, information processing, physiological mechanisms, and the ontogeny of perception.

• Psychology 49.545T2
Quantitative Psychology
A problem-oriented approach to graphic methods, statistical estimation, correlation techniques, regression analysis, chi-square, other selected non-parametric techniques, and analysis of variance. Computer techniques will be integrated with the course content.

• Psychology 49.551F1
Developmental Psychology I
A detailed examination of selected issues in developmental psychology.

• Psychology 49.552W1
Developmental Psychology II
A continuation of 49.551.

• Psychology 49.561W1
Contemporary Research in Personality
Current controversial issues in personality research and selected theoretical and research studies in personality.

• Psychology 49.570F1
Research Methods in Learning
Methods, research design and instrumentation in the fields of learning and retention, with emphasis on response definition and measurement, procedures for monitoring the learning process, and problems of control.

• Psychology 49.573W1
Human Learning
A discussion of selected topics within the area of human learning.

• Psychology 49.575F1
Behaviour Modification I
The basic principles of learning as they apply to the modification of behaviour, with emphasis on application, ethics, research and methodology.

• Psychology 49.576W1
Behaviour Modification II
Special problems, topics, and projects related to behaviour modification.
Prerequisite: Psychology 49.575.

• Psychology 49.580F1, W1
Special Topics in Psychology
The topic of this course will vary from year to year and will be announced in advance of the registration period.

• Psychology 49.590F1, W1, S1
Directed Studies
An investigation in depth of selected problems in psychology by means of directed library research.
Registration is restricted, permission to register being granted only by the Graduate Committee. A final report must be filed in department office prior to submission of course grade.

• Psychology 49.591F1, W1, S1
Independent Research
Permission to register and approval of research plan must be obtained from the Graduate Committee. A final research report must be filed in department office prior to submission of course grade. This course may be repeated for credit.

• Psychology 49.599F4, W4, S4
M.A. Thesis

• Psychology 49.610F1
Research Seminar in Social Psychology I

• Psychology 49.611W1
Research Seminar in Social Psychology II

• Psychology 49.620F1
Research Seminar in Physiological Psychology I

• Psychology 49.621W1
Research Seminar in Physiological Psychology II

• Psychology 49.626F1
Comparative Psychology
Varied and acquired adaptive mechanisms and their phylogenesis. Topics will include attachment behavior, social organization, learning abilities, communication and motivation.

• Psychology 49.650F1
Research Seminar in Developmental Psychology I

• Psychology 49.651W1
Research Seminar in Developmental Psychology II

• Psychology 49.670F1, W1
Research Seminar in Learning

• Psychology 49.675W1
Teaching Techniques in Psychology
Designed for persons pursuing a career in academic psychology. Literature on teaching effectiveness is examined and students are given experience in the preparation of classes and course planning.

• Psychology 49.680F1, W1
Special Topics in Psychology
(Same description as 580)

• Psychology 49.690F1, W1, S1
Directed Studies
(Same description as 590)

• Psychology 49.691F1, W1, S1
Independent Research
(Same description as 591)

• Psychology 49.699F, W, S
Ph.D. Thesis

Through inter-university cooperation in graduate instruction, full-time graduate students registered in the Department of Psychology may enroll in one course at the University of Ottawa.

The School

Director of the School: G. Bruce Doern

The School of Public Administration was established in 1953 through the assistance of a generous grant from the Atkinson Charitable Foundation.

The School offers two graduate programs of study and research in the field of administration. Prospective applicants are urged to evaluate these two opportunities carefully in order that they may select the one most suitable to their interests, background and academic qualifications.

Diploma in Public Administration (D.P.A.)
A program designed to offer those persons in (or planning to enter) administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies. This diploma program, which consists of five full courses or the equivalent, is more fully described below.

Master of Arts
The M.A. program is designed to provide a balanced exposure to both administrative studies and to public policy. It is more fully described on the following pages.

Inquiries and requests for further information may be directed to the School.

Graduate Diploma in Public Administration

The Diploma in Public Administration is designed to offer those persons in, or planning to enter, administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies. The program consists of five courses and may be taken on a part-time, mid-career or full-time basis.

The program is based on the recognition that persons with widely varying backgrounds will enter the program. Students who successfully complete the D.P.A. program may apply for admission to the M.A. program, at which time they will be considered for admission along with all other applicants. If all of the First Year courses are not taken as part of the D.P.A., they will be required in addition to the final year M.A. courses.

Admission Requirements

To be considered for admission, an applicant must have a Bachelor's degree with at least second-class standing from a recognized university, and must have completed courses in Introductory Economics (Economics 100 or 101, or the equivalent) and Canadian Government and Politics (Political Science 200 or equivalent).

Program Requirements

The program consists of five full course credits, at least four of which must be completed at Carleton. Advanced standing may be granted in one full course (or equivalent) if previous work is judged to be equivalent to courses required in the program. A student who has taken one (or more) of the other required courses prior to admission, must substitute another course (or courses) in consultation with the Director. In the event that a part-time student is required by his employer to move away from Ottawa, he may apply to complete one full course or the equivalent at another university provided that no transfer of credit was granted on admission.

Students are required to complete the following program:

- Administration 50.510, Management Accounting and Administration and 50.511, Financial Management;
- Administration 50.522, Economics for Management and Policy I and Administration 50.523, Economics for Management and Policy II or one full course or two half-course options;
- Administration 50.530, Organizational Behaviour I and Administration 50.531, Organizational Behaviour II;
- Administration 50.536, Law of Public Authorities I;
- Administration 50.500, Public Sector Managing and the Canadian Political System;
- Administration 50.567, Public Sector-Private Sector Relations;

• Administration 50.568, Policy and Decision Making;

Part-time students already admitted to the D.P.A. program under the provisions of previous calendars may adjust their programs to take advantage of the revised program outlined above.

Academic Standing

All candidates are required to obtain a grade of B– or better in each course in the program. A candidate may, with the recommendation of the School and the approval of the Faculty of Graduate Studies and Research, be allowed a grade of C+ or C (but not C–) in one full course or each of two half-courses.

Master of Arts

The Master's program is specifically designed to provide the prospective and the mid-career administrator with a balanced exposure to administrative studies and to public policy.

The contemporary manager or administrator is increasingly required to be both a policy adviser and formulator and to have a substantive understanding of the many disciplines and variables associated with the decision-making process in contemporary organizations. University programs can begin to provide some of the foundations that will enable persons to acquire an understanding of the broad financial, legal, economic, political and social interrelationships that affect decisions in any organization.

The program is designed to prepare students for managerial, policy and managerial support roles in the public services of Canada (federal, provincial, regional, municipal), and to accelerate and enrich the education and the development of those already performing such roles. Because it is conducted in conjunction with and draws upon a program of advanced research in administrative studies and public policy, it is also designed to meet the educational needs of those wishing to undertake graduate level work in public policy and management, but who may not have a current commitment to public service careers.

Basic Characteristics of the Program

• *The combining of academic quality and professional relevance*

The program is a university one and at graduate level. This means that it requires of participants the academic performance and commitment of all graduate students, with admission standards reflecting this requirement. At the same time, it is a career-oriented program, emphasizing performance in extremely demanding roles in public sector organizations; as such, it reflects the direct and longer-term professional requirements of the public services.

• *The core program and public sector applications*

A key premise of the program is that public sector managerial, policy and managerial support personnel require the rigorous foundation in the management, policy and behavioural sciences that has come to be acknowledged in business administration programs. The severe limitation of existing business administration programs, in preparing students for public sector roles, is that the core program is understandably related, in subsequent studies, to business sector concerns, issues and institutions. A Master of Business Administration graduate normally brings to the public sector a highly useful set of skills, techniques and approaches primarily because he has had the rigorous foundations program. By following the Master's program in Public Administration, a graduate will bring this foundation, but with valuable additional strengths acquired from a full year of disciplined application of the core program to public sector concerns.

• *A stress on developmental experiences*

The program recognizes that educational experiences taking place within a university are a complement to, rather than a substitute for, practical work experience in terms of the development of potential.

Optimum development towards potential is seen as sequential, cumulative, and continuous: it can start at any career point, either in the work situation or in a formal education program; at some point, however, an effective alternation of on-the-job experiences and formal education is required. This is recognized in three ways: (1) students without prior work experience are

encouraged to accept internships within the public services as a regular component of their programs;
(2) special stress is placed on the Mid-Career Program (described in detail below), a degree program based on considerable prior work experience; in addition, the "on-campus" requirements are such that less time away from the work situation is required;
(3) the programs seek to blend academic excellence with the insights coming from the working environment: through the teaching materials used, through faculty experiences in public sector research or assignments, and through involving public servants in seminar leadership and teaching roles.

• *The resources of the national capital*

The academic staff and the students in the School reflect a broad cross-section of disciplines and backgrounds. This is an important feature of the opportunities available inasmuch as the programs are intended to expose students with varying backgrounds to a basic understanding of the contribution of the core disciplines.

The School of Public Administration, because of its location in Ottawa, is able to provide the student with a unique exposure to the resources and personnel located in the national capital. The study of public administration and public policy can be pursued with a total range of resources not readily available in other locations.

The School cooperates fully with the Faculty of Management Sciences at the University of Ottawa. Many courses offered at the University of Ottawa are available to be taken as part of the students' optional second year courses. Thus, a cooperative joint Program in Public Policy and Management is available drawing upon the combined resources of the two universities.

All students already admitted to the Master's program on the basis of previous calendar requirements may continue their program according to the terms of their current Statement of Standing on Admission. Students should contact the Director of the School if they are in doubt as to their status or their remaining program requirements.

Degree Schedules

The degree can be taken in one of three basic ways: full-time, part-time, or through a special Mid-Career Program. It is also possible for the individual student to combine elements of all three approaches. The three schedules are as follows:

• The Full-time Schedule

A student attending full-time will normally complete the program in four academic terms, each of approximately 13 weeks' duration. At present, a full range of courses is offered in only two terms yearly: September - December and January - April. The program, comprising 20 half-courses, is therefore completed on a schedule of five half-courses per term. By taking advantage of part-time summer courses, the residential requirement can be reduced to three terms.

• The Part-time Schedule

Courses are offered on a part-time basis. A part-time student normally completes from two to four half-courses during the regular academic year, through evening courses or by joining regular day-time courses. Certain part-time courses are scheduled during the summer term. The duration of a part-time program, therefore, normally varies from four to five years.

• Mid-Career Schedule

To qualify for the mid-career program a student must have spent several years in one of the public services, or performing managerial or related functions in a private sector organization. The student must also meet the admission requirement for entry to the graduate program; while the *schedule* is different from the full-time program, in matters of expected levels of academic performance, the two programs are identical.

What is unique about the program is that it combines elements of the full-time and part-time programs, while adding a special Directed Studies component on a schedule built around the expectation that students will alternate periods of intensive study with their normal work. The schedule comprises the following:
(1) *A Residential Semester*, lasting 12-13 weeks, during which mid-career students complete five half-courses.
(2) *A Normal Work Period*, normally during which students complete four half-courses,

through part-time courses or special "Directed Studies" courses. In a "Directed Studies" course students are not required to attend the normal on-campus university courses, working instead in a close individual relationship with a professor on a schedule mutually agreed upon.
(3) *A Second Residential Semester*, again lasting 12-13 weeks, during which five half-courses are required.
(4) *A Normal Work Period*, during which students will complete the remaining six half-courses of the graduate degree.

Admission Requirements

To be considered for admission, an applicant must have a Bachelor's degree or equivalent with at least second-class standing from a recognized university, and must have already completed courses in Introductory Economics (Economics 43.100 or 43.101 or equivalent), and Canadian Government (Political Science 47.200 or equivalent).

The School's admission policy will, of course, be governed by the availability of graduate student spaces and the need to admit applicants from a variety of disciplines and backgrounds (for example social sciences, humanities, law, engineering, science). Possession of the minimum admission requirements does not, in itself, guarantee acceptance.

Advanced standing may be granted if previous work is judged to be equivalent to courses required in the program. Advanced standing and transfer of credit must be determined on an individual basis in consultation with the Director, and must also be approved at the time of admission by the Dean of the Faculty of Graduate Studies and Research.

Program Requirements

The M.A. program comprises 20 half-courses (or the equivalent).

First Year Courses

- Admin. 50.500 Public Sector Managing and the Canadian Political System
- Admin. 50.510 Management Accounting
- Admin. 50.511 Financial Management
- Admin 50.522 Economics for Management and Policy I
- Admin. 50.523 Economics for Management and Policy II
- Admin. 50.530 Organizational Behaviour I
- Admin. 50.531 Organizational Behaviour II
- Admin. 50.550 Quantitative Methods
- Admin. 50.567 Public Sector - Private Sector Relations

Students who successfully complete the First Year program with the required standing may be awarded the Diploma in Public Administration, provided that four full courses have been taken at Carleton University.

Second Year Courses

- Admin. 50.568 Policy and Decision Making;
- Admin. 50.536 Law of Public Authorities I;
- three half-courses, one selected from each of the first three streams listed below;
- five half-courses (or equivalent) selected from any of the course streams listed below, OR
- a thesis (equivalent to four half-courses) and one half-course option, OR
- a research essay (equivalent to two half-courses) and three half-courses.

Note: Courses with MSG prefixes are offered by the Faculty of Management Sciences at the University of Ottawa.

The School wishes to encourage students to develop their French language skills. Accordingly students who wish to do so may take an approved university French language full course as one of their options.

Public Policy Stream

Administration

50.501 Policy and Administration in Intergovernmental Relations
50.565 Government-Industry Policy Relations
50.566 Science and Technology Policies
50.569 Advanced Policy and Decision Analysis
50.570 Policy Seminar (Health Care Policy)
50.572(A) Policy Seminar (Foreign Investment Policy)
50.573 Policy Seminar (Social Policy)
50.574 Urban Policy Analysis
50.590 Directed Studies

Political Science

47.547 Decision Theories and Policy Studies

Economics

43.580 Urban Economics
MSG Advanced Policy Analysis Workshop I

Public Sector Management Stream

Administration
50.513 Public Sector Budgeting
50.515 Public Sector Management
50.537 Law of Public Authorities II
50.561 Planning in Government
50.583/MSG 6111 Problems in Organizational Change and Development
50.590 Directed Studies

Political Science
47.540 Problems in Canadian Public Administration
47.544 Public Administration in Developed Western Countries

Law
51.555 Administrative Law II

Specialist Functional Stream: Personnel, Finance, Marketing, Operations Research

Administration
50.512 Management Information Systems
50.514 Public Sector Accounting and Finance
50.581 Staffing and Personnel Management
50.584 Public Sector Collective Bargaining

Law
51.445 Staff Relations in the Public Service

Economics
43.465 Industrial Relations

Sociology
53.526 Sociology of Occupations and Professions

University of Ottawa
MSG 6131 Quantitative Models for Manpower Planning
MSG 6117 Manpower Resources Development
MSG 6161 Seminar on Behavioural Sciences

University of Ottawa
MSG 6103 Managerial Accounting II
MSG 6115 Managerial Economics III
MSG 5106 Operations Research I
MSG 5108 Operations Management
MSG 5116 Operations Research II
MSG 6112 Linear Programming
MSG 6113 Decision Theory
MSG 8901 Networks Analysis
MSG 6116 Stochastic Processes in Operations Research
MSG 8902 Selected Topics in Operations Research
MSG 5509 Marketing I
MSG 6109 Marketing II
MSG 6154 Models in Marketing

Government-Industry Relations Stream

Administration
50.565 Government-Industry Policy Relations
50.566 Science and Technology Policies
50.572 Policy Seminar (Foreign Investment Policy)

Sociology
53.529 Sociology of Science and Technology

International Affairs
46.530 The International Enterprise

Economics
43.410 Finance and Capital Markets
43.430 Industrial Organization and Public Policy

Urban and Intergovernmental Relations Stream

50.501 Policy and Administration in Intergovernmental Relations
50.517 Urban and Local Government Management
50.574 Urban Policy Analysis

Economics
43.440 Public Finance
43.580 Urban Economics

Political Science
47.409 French Canadian Politics
47.450 Federalism
47.500 Problems of Canadian Local Government and Politics
47.501 Problems of Canadian Provincial Government and Politics
47.502 Comparative Local Government

Law
51.374 Local Government Law

Geography
45.445 Land Resource Use

International and Comparative Administration Stream

Administration
50.517 Public Management in Developing Countries

Political Science
47.544 Public Administration in Developed Western Countries
47.545 Public Administration in Developing Countries
47.561 Development of Canadian External Relations
47.562 Issues in Canadian Foreign Policy
47.597 Problems in International Organization

International Affairs
46.500 International Integration
46.505 Political and Economic Development
46.530 The International Enterprise

Law
51.420 International Economic Law I
51.421 International Economic Law II
51.463 Public International Law

Economics
43.460 International Trade

Geography
45.520 Spatial Aspects of Development - Africa
45.521 Spatial Aspects of Development - Asia

Academic Standing

All candidates are required to obtain a grade of B- or better in each course in the program. A candidate may, with the recommendation of the School and the approval of the Faculty of Graduate Studies and Research, be allowed a grade of C+ or C (but not C-) in one full course or two half-courses.

First Year Courses*

• Administration 50.500F1
Public Sector Managing and the Canadian Political System
An examination of the central features and influences of the Canadian political system on public service managerial and policy roles. An examination of the application of managerial concepts and approaches in Canadian public administration.
Prerequisite: Political Science 47.200.
G.B. Doern, V.S. Wilson and I. Krupka.

• Administration 50.510F1
Management Accounting
An introduction to the underlying assumptions and basic principles of accounting and an examination of the uses of accounting information by management. Topics include income measurement, asset valuation, financial statement analysis, cost systems, control reports, operating budgets, capital expenditure decisions, and alternative choice problems.
A. Blair.

• Administration 50.511W1
Financial Management
An examination of the principles and practice of financial planning and control. Analysis of the problems of resource allocation and asset management under conditions of uncertainty. Techniques of capital expenditure analysis, and analysis of funds flow.
Prerequisite: Administration 50.510 or permission of instructor.
R. Levesque, S. Diener and B. DeCotret.

• Administration 50.522F1
Economics for Management and Policy I
An examination of the concepts and uses of macro-economic theory and methods in total social resource allocation, including fiscal and monetary policy.
Prerequisite: Economics 43.101.
K. Hay.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

• Administration 50.523W1
Economics for Management and Policy II
An examination of the concepts and uses of micro-economic theory and methods in organizational resource allocation.
Prerequisite: Economics 43.101.
A. Maslove and S. Borins.

• Administration 50.530F1
Organizational Behaviour I
An examination of basic theories and approaches to the motivation of workers in organizations, the analysis of individual behaviour in organizations from the perspective of worker motivations, and the examination of current tools such as job enlargement participation models and M.B.O. for improving worker motivation and coping with organizational change.
D. Swartz, A. Barnhill and J. Chenier.

• Administration 50.531W1
Organizational Behaviour II
An examination of organizational behaviour from an open systems perspective which focuses on the organization as a whole. Focus will be on topics such as coordination and control, authority and power, conflict and cooperation between organizations and interactions between organizations and their various constituencies.
Prerequisite: Administration 50.530.
D. Swartz, A. Barnhill and J. Chenier.

• Administration 50.550T2
Quantitative Methods I
An introduction to the theory of measurement and various methods of data collection and causal analysis. Under the guidance of the instructors, students are expected to devise their own research designs, and analyze empirical data with the use of the computer.
E. Swimmer and S. Borins.

• Administration 50.567W1
Public Sector - Private Sector Relations
An examination of basic theories and interpretations regarding the roles of, and interrelationships between, the state, corporations, labour unions, the professions and other elements of the private sector.
Prerequisite: Political Science 47.200.
G.B. Doern, I. MacDonald and D. Swartz.

Second Year Courses

• Administration 50.501T2
Policy and Administration in Intergovernmental Relations
An examination of the policy and administrative relations among the federal, provincial and urban governments in Canada. The course will explore selected substantive policy and program areas, including tax policy, social security and social welfare policies, health care, and economic development programs.
I. MacDonald.

• Administration 50.512T2
Management Information Systems
An examination of information and decision networks of complex organizations, including general systems theory and information theory concepts, decision models and specifications of information requirements, systems analysis and sub-system modules, and hardware and software considerations.
A. Blair.

• Administration 50.513W1
Public Sector Budgeting
An examination of selected problems in public sector budgeting and expenditure analysis, including cost-benefit analysis, planning programming and budgeting and concepts of cost effectiveness.
A. Maslove.

• Administration 50.514W1
Public Sector Accounting and Finance
An examination of selected problems in accounting and financial management in public sector organizations.
G. Ross.

• Administration 50.515F1
Management in the Public Service
An examination through cases and research of selected problems and issues in public service management, including management by objectives, the management of supplies and services, contract management, the issues of "make or buy" in general resource procurement, and other contemporary issues and practices.
D. Hartt.

• Administration 50.516W1
Urban and Local Government Management
An analysis of the principle issues and processes of Canadian urban and local government management and administration.

• Administration 50.517W1
Public Management in Developing Countries
An applied analysis of selected issues in public management and administration in developing countries.
J. Nellis.

• Administration 50.536F1
Law of Public Authorities I
Introduction to basic legal principles, structures and processes for the public administrator. Character of law and public law; constitutional framework; legal sanctions and basic principles of legal control. Statutory discretion from the administrator's point of view.
D. Abbott.

• Administration 50.537F1
Law of Public Authorities II
Characteristics and problems of control of administrative action. Varieties of legal control, judicial review, discretion, privative provisions and damages, appelate control, statutory reform.
Prerequisite: Administration 50.536.

• Administration 50.561T2
Planning in Government
An examination using cases and simulation of selected concepts, issues and circumstances in applied governmental planning.
M. Doctoroff and G. Milne.

• Administration 50.565T2
Government-Industry Policy Relations
An examination of the main policies, programs and strategies of those government departments (federal and provincial) which have the most direct interface with the industrial and corporate sector in Canada. These departments include Industry, Trade and Commerce, Treasury and Economics, Consumer and Corporate Affairs, etc.
D. Kelly and D. Osborne.

• Administration 50.566S1
Science and Technology Policies
An examination of Canadian programs, policies and strategies toward the development of scientific and technological capability and towards the use of science and technology in social and economic programs.
G.B. Doern.

• Administration 50.568F1
Policy and Decision Making
An examination of policy and decision making theories and processes. The course examines the processes of formulating objectives and of making decisions under conditions of relative certainty and uncertainty. Policy and decision theory and processes in the public and private sectors are compared and contrasted.
G.B. Doern, S. Borins and R. Van Loon.

• Administration 50.569W1
Advanced Policy and Decision Analysis
An analysis of advanced concepts in policy and decision analysis drawing upon organizational, political and economic analysis.
Prerequisite: Admin. 50.568, 530/531 or permission of the instructor.
S. Borins.

• Administration 50.570T2
Policy Seminar
An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy field in terms of its many-sided economic, political, social, legal, quantitative and administrative complexities.

• Administration 50.571S1, F1, W1
Policy Seminars
An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy area in terms of its many-sided economic, political, social, legal, quantitative and administrative complexities. The policy field will change each year.
50.571F1: Transportation Policy and Foreign Investment Policy.
50.571W1: Social Policy and Health Care Policy.
A. Maslove, D. Swartz, A. Litvak and S. Borins.

• Administration 50.574F1
Urban Policy Analysis
An analysis of the urban policies of all three levels of government in Canada and their interactions. The course examines policy processes

as well as a number of substantive urban policy issues.
A. Maslove.

• Administration 50.581W1
Staffing and Personnel Management
An examination of the staffing and personnel management functions in large public and private organizations, including recruitment, selection, and performance appraisal, reward systems, and the roles of staffing professionals.
D. Richards and P. Rainboth.

• Administration 50.583F1
Problems in Organizational Change and Development
An examination, through case work and group projects, of the concepts and issues of planned organizational changes.
H. Kroeker.

• Administration 50.584F1
Industrial Relations and Public Sector Collective Bargaining
An analysis of the basic concepts of industrial relations policy and practice with particular emphasis on their relationship to public sector employees and organizations.
E. Swimmer.

• Administration 50.585W1
Public Sector Collective Bargaining
An application of the basic concepts, legislation and public policies regarding public sector collective bargaining at the federal, provincial and municipal levels of Canadian government. Cases and simulated negotiations will be used where appropriate.
Prerequisite: Admin. 50.584 or permission of instructor.
E. Swimmer.

• Administration 50.590T2, F1, W1, S1
Directed Studies
A tutorial or directed reading course on selected subjects.

• Administration 50.598F2, W2, S2
Research Essay

• Administration 50.599F4, W4, S4
M.A. Thesis

School of Social Work

The School

Director of the School: S. James Albert

The School of Social Work offers a graduate academic professional program leading to the degree of Master of Social Work.

The program at the School has been expanding for several years and new areas of social work practice continue to be built into the curriculum. Currently the School is placing emphasis on two major study areas.

The first is related to the need for direct practitioners who can offer their services to individuals, families, and groups in need. There is considerable individual need, suffering and injustice being experienced by families, children, old people, and others. Pressures of society are contributing to the toll of family and emotional suffering; traditional primary institutions such as the family are undergoing modification and in many cases no longer provide needed support. It is hoped that skilled social work practitioners can help families, individuals and communities through some of these crises and help them to effectively address the individual and societal pressures they are facing.

The School places a very strong emphasis on sensitivity to the individual and on the development of new and innovative strategies for working with individuals and their environments. An individual or family crisis may be generated in large part or in whole by factors in the environment such as employment patterns, housing policies and practices, economic policies and practices, economic policies and a lack of family support services. It is essential that the direct practice social worker be aware of all these factors and be prepared to act to change the situation.

The School's orientation explicitly includes approaches to social problem solving, social development, and social change which involve working directly with individuals and groups, in addition to any 'indirect' approach aimed more at social administration in agencies and contributions to social policy formulation. However, we have moved away from the medical model of individual pathology, with its emphasis on individual behavior change and adaptation to the system, which was once a major part of the traditional program of this School.

Thus, community work is built into the direct intervention model. The School places considerable emphasis on community analysis and awareness, and on knowledge of the social policies that affect the lives of so many people in our society. Some practitioners may emphasize community work more than others, but all should be involved in it.

The second major area of study is social administration and policy. Social relations in our society are affected by a variety of public policies and procedures. The need for new public responses in the form of policies and programs is ever present. Since the School is situated in Ottawa, the centre of federal public policy-making, it is sensible that a good measure of its interests and resources be directed towards this area.

Although there are two major areas of study, the program is not designed to direct an individual participant into one area or the other. It is hoped that individual educational planning can allow students to put together their own program which, for some, may well involve a concentrated effort in both areas of the program. The School insists, however, that all students appreciate the value of each of the two major areas and the interrelatedness of the two.

The program includes the following major curriculum segments:

- an understanding of social structure and individual and collective behavior;
- understanding of the method and process of social work intervention;
- understanding of the social policy process and social work's participation in it;
- research knowledge and skills and their application to questions dealing with social work practice, with particular emphasis on the evaluation of social work practice and of programs;
- field work, an opportunity for students to test out aspects of the academic curriculum within a practical setting, and to work with professionals involved in social work and related fields.

Part-time Degree Program

The School of Social Work launched a part-time degree program in the Fall of 1974 lead-

ing to the Master of Social Work. This program is perceived as a natural outgrowth of the School's established interest in the accessibility of graduate level education to larger population groups. It is anticipated that the part-time program will attract competent candidates, who, due to a range of circumstances, cannot participate in a program of full-time study. M.S.W. requirements in the part-time program are identical to the regular program; the time allowed for completion of the degree by part-time study is currently six years.

Master of Social Work

Admission Requirements

Admission to the School is on a selective basis.

All applicants will have received their Bachelor's degree, or be in their final year of undergraduate study prior to graduating from a recognized college or university. A "B" standing at the undergraduate level is expected. Currently there are not required subjects at the undergraduate level, but it is strongly recommended that applicants have a background in the social sciences.

Applicants with a B.S.W. degree, or graduate work in a related discipline, are considered individually for advanced standing in the program.

Application is made on the forms available from the Admissions Office at the School of Social Work. All applications should be received at the School by February 15th.

Program Requirements

Candidates for the degree Master of Social Work are required to complete, at a satisfactory level, ten full credit courses (or equivalent) including:

- a minimum of one period of field work (credit value 2.0), and a maximum of two periods of field work (credit value 4.0);
- an Independent Enquiry Project (credit value 1.0), or equivalent.

First year students are required to take academic courses in the first term of their program. The field seminar may be taken during any term of the calendar year except the first term of a student's program.

Academic Standing

The School operates within the evaluation and grading system of the Faculty of Graduate Studies and Research.

A student must obtain at least an overall B– average in the first two terms of study to be eligible for promotion into the third term. With the approval of the School of Social Work a student may obtain, in the first two terms of study, one full credit course or two half-credit courses with a grade of C or C+ (but not C– or below).

A minimum grade of B– must be obtained in each course taken during the final two terms of the program.

It is expected that full-time students will complete the program within two years; the maximum time allowed for completion is five years after initial registration.

Graduate Courses*

It is expected that students will complete at least one of 52.520 or 52.523, at least one of 52.503 or 52.505, and 52.500, 52.510, 52.530 and 52.539 (or equivalent). All students are required to complete 52.540.

- Social Work 52.500F1

Social Structure and Community Analysis
A survey of social science concepts and theories relevant to analyses of society and communities, focussing on social structure and community organization as these influence human behavior and social development.

- Social Work 52.501F1, W1

Human Behavior
Emphasis is on the perspective provided by different personality theories, and the different models they produce. The focus for this behavior analysis will be on the implications it has for

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

social work practice and intervention methodology.

• Social Work 52.505F1, W1
Organizational Behavior and Theory
An introduction to understanding the behavior of individuals, members and clients, in complex organizations, and to understanding the properties, structures and processes of complex organizations, small bureaucracies and micro-treatment organizations.

• Social Work 52.506F1, W1
Special Problem Seminars
A range of special problem seminars will be offered according to the interests of faculty and students. Social workers in the field will also participate. Topics may include alcoholism, mental retardation, ageing, native rights, women's rights, etc.

Social Policy

• Social Work 52.510F1
Social Policy I
An introductory course in social policy analysis reviewing theoretical approaches to analyzing the development and implementation of social welfare policies. The course examines the history and function of social policies and the role of social work in formulating and implementing policies.

• Social Work 52.511F1
Social Policy II
An elective course aimed at the study of a particular social policy.

• Social Work 52.512W1
Social Policy III
Further studies in social policy and social planning. Examination of strategies for influencing the development of policies at either an organizational level or a geographic jurisdictional level.

Practice Intervention

• Social Work 52.520F2, W2
Direct Intervention
An introduction to the theoretical underpinnings for social work intervention with individuals, families, small groups, and communities. The aim is to prepare students as generalist practitioners and is addressed to the solution and/or prevention of problems at all levels of society.

• Social Work 52.521F2
Special Topics
A number of specialized topics in the area of methodology, such as crisis intervention, family therapy, group work and in particular areas of practice such as medical social work, child welfare.

• Social Work 52.522W2
Special Topics
Specialized topics in the area of methodology according to the interests of faculty and students.

• Social Work 52.523F2, W2
Social Administration and Policy I
An introductory methods course providing an understanding of the values, skills and knowledge required for the effective performance of middle management and planning roles. The seminar will cover administrative, planning and policy methods with an emphasis on the social welfare and health agencies as the system context for practice.

• Social Work 52.524F2
Social Administration and Policy II
Emphasis is on the community and social service delivery systems and policy development at the municipal, provincial and federal levels. The seminar will focus on planning theories and models, legislative analysis and planning, management styles and decision-making processes, organizational renewal strategies and human service delivery design.

• Social Work 52.525W2
Social Administration and Policy III
The focus is on issues of programme consultation and development, and long-range strategic planning for the human services and the voluntary sector. Students will have an opportunity of integrating previous practice and field experience towards a better understanding of skill refinement required for entry into professional practice.

• Social Work 52.526F1, W1
Community Practice
A comparison of practice methods of community intervention related to the analysis of participating communities, needs and resources, and the role of the social worker and social work agency in relationship to other community

practitioners, and the involvement and participation of citizens.

Research

• Social Work 52.530F2
Research Planning Seminar
The course focusses on the methodological issues of the research process-problem formulation, developing hypotheses, research designs, data collection instruments and procedures, and data analysis.

• Social Work 52.531F1
Evaluative Research
Relying on principles of basic research methods, this course will pay special attention to the issues of planning and conducting research which aims to determine the extent to which social interventions are accomplishing their stated goals.

• Social Work 52.532W2
Advanced Research Methods Special Topics
Depending on student and faculty interests, the following courses could be offered: data analysis, use of computers, statistics, and program evaluation.

• Social Work 52.539F2, W2, S2
Independent Enquiry Project
Students will demonstrate their understanding of research methods by undertaking a research project, assisted by a faculty adviser.

Field Practice

• Social Work 52.542W4
Field Practice I
Eighteen weeks of full-time practice instruction in settings that provide a broad exposure to human needs and social issues of central concern to social workers. Students with considerable social work experience are encouraged to build upon this experience through developing special field practice projects.

• Social Work 52.543F4, W4
Field Practice II
Twenty-one weeks of full-time practice instruction in settings related to the specific educational and professional interests of individual students. Method specializations are available in various combinations of casework, group work, family therapy, community organization and development, social policy planning, administration and research.

Courses not offered in 1976-77:
52.502 Abnormal Behavior
52.503 Study of the Family
52.504 Group Theory

Department of Sociology and Anthropology

The Department

Chairman of the Department: D. Forcese
Departmental Supervisor of Graduate Studies: S. Richer

The Department of Sociology and Anthropology offers programs of advanced study and research leading to the M.A. and Ph.D. degrees in Sociology, and the M.A. in Anthropology.

The principal focus of departmental interest in Sociology at the graduate level is Comparative Social Organization, with complementary specialization in the study of Social Demography-Ecology and Theory-Methodology. The research emphasis is on industrial and industrializing societies. The institutions of Canadian Society - in particular, class, ethnic, political and regional structures - are examined in historical and comparative perspective.

The principal foci of the Anthropology graduate program are (a) Ecological Anthropology, and (b) theory and methods in formal analysis. The latter are broadly defined to include such issues as exchange theory, behaviourist models in Anthropology, decision theory, and Structuralism. There is a strong ethnographic component in the program, with particular emphasis on North America and on Africa south of the Sahara.

The current activity of the members of the department is as follows:

Comparative Social Organization

Comparative Societies
R. Crook, J. Harp, B. McFarlane, J. Porter, A. Steeves, D.R. Whyte

Comparative Institutions
C. Farmer, D. Forcese, M. Frumhartz, J. Harp, K. Hatt, G. Irving, J. Porter, S. Richer, J. Vantour, F. Vallee

Occupations and Formal Organizations
C. Gordon, B. McFarlane, A. Steeves, V. Valentine

Social Stratification and Mobility
M. Boyd, D. Forcese, K. Hatt, J. Porter, A. Steeves

Social Anthropology

V. Blundell, J. Cove, B. Cox, J. Keil, J. Manyoni, I. Prattis, D. Smith, D. Stewart, V. Valentine, F. Vallee

Social Demography-Ecology

M. Boyd, K. Mozersky, I. Pool, L. Stone, J. de Vries

Theory-Methodology

H. Burshtyn, R. Crook, D. Forcese, Z. Jordan, G. Neuwirth, T. Nosanchuk, J. de Vries, C. Steffens, D. Whyte

The Department of Sociology and Anthropology has access to the Canadian Institute of Public Opinion poll data and the Human Relations Area Files, and is a member, in cooperation with other social science departments, of the Inter-university Consortium for Political Research. Other data sets and archival holdings are also available in the Department. Because of the location in Ottawa of Statistics Canada, the National Museum, the National Library, the National Science Library, the Archives and the headquarters of every government department, Ottawa is an excellent base of operations for sociological research.

The graduate program in Anthropology enjoys an especially close relationship with the Sociology graduate program and, while certain members of the Department are primarily identified as Anthropologists, a number of Sociologists may also be called upon for particular contributions to the program. There are other valuable resources in the School of International Affairs and the Committee on African Studies.

Qualifying Year Program

Applicants with general (pass) Bachelor's degrees may be admitted into a Qualifying Year program designed to raise their standing to Honours status, with at least high second-class (B+) standing in their qualifying year courses to be considered for admission into the Master's program.

Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Arts in Sociology

Admission Requirements

The requirement for admission into the Master's program is an Honours B.A. (or the equivalent) with at least second-class standing. In current practice, a high second-class (B+) standing is normally required for consideration for admission into the program.

Program Requirements

Master's students in Sociology are required to select and follow one of the following optional program patterns chosen in consultation with a graduate advisor:

Thesis Program

- Three full courses (or the equivalent); under certain circumstances two of the courses may be selected from those offered at the senior undergraduate level.
- a thesis equivalent to two full course credits;
- an oral examination on the candidate's thesis and program.

Course Work Program

- Five full courses (or the equivalent); under certain circumstances two of the courses may be selected from those offered at the senior undergraduate level.
- written and oral examinations on the candidate's area of specialization;
- an oral examination on the candidate's program.

Academic Standing

A grade of B– or better must normally be obtained in each course counted toward the Master's degree. With the recommendation of the Department, a candidate may be allowed a grade of C (but not C–) in one full course or each of two half-courses.

Master of Arts in Anthropology

Admission Requirements

The requirement for admission into the Master's program is an Honours B.A. (or the equivalent) with at least second-class standing. In current practice, a high second-class (B+) standing is normally required for consideration for admission into the program.

Program Requirements

Master's students in Anthropology are required to select and follow one of the following optional program patterns chosen in consultation with a graduate adviser:

Thesis Program

Three full courses (or the equivalent) consisting of:

- one of 54.504 or 54.508;
- one of 54.516 or 54.517;
- one and one-half additional credits selected from the Anthropology graduate course offerings; from courses offered in the Sociology graduate program (especially in theory and methods); from 400 level courses offered in the Sociology and Anthropology undergraduate program; or any combination of these selected in consultation with the student's graduate adviser. Courses in other programs in the University may also be selected (for example, Political Science 47.581, Geography 45.330), but not in excess of one full course (or the equivalent).
- a thesis equivalent to two full course credits;
- an oral examination on the candidate's thesis and program.

Course Work Program

Five full courses (or the equivalent) consisting of:

- both 54.504 and 54.508;
- both 54.516 and 54.517;
- two additional course credits as described in the Thesis Program above, chosen in consultation with the student's graduate adviser;
- a written and an oral comprehensive examination on the candidate's program.

Academic Standing

A grade of B– or better must normally be obtained in each course counted toward the Master's degree. With the recommendation of the Department, a candidate may be allowed a grade of C (but not C–) in one full-course or each or two half-courses.

Doctor of Philosophy in Sociology

The substantive focus of the Ph.D. program is the organization and development of modern societies, both in a comparative context and with particular reference to Canadian society.

Admission Requirements

The minimum requirement for admission into the Ph.D. program is a Master's degree (or the equivalent) in Sociology, with a minimum average of B+ in courses (including the thesis where applicable), and with no grade below B.

Applicants who have deficiencies in certain areas may be admitted into the Ph.D. program, but will normally be required to complete additional course work.

Program Requirements

The specific program requirements of the Department of Sociology and Anthropology are the following:

- ten full courses (or the equivalent), including 53.600 and a thesis equivalent to a maximum of seven full courses or a minimum of five full courses;
- written and oral comprehensive examinations in three areas of specialization;
- an oral examination on the subject of the thesis and fields related to the candidate's Ph.D. program.

Comprehensive Examinations

Each Ph.D. candidate is required to write a total of three comprehensive examinations. At least one (but not all) of the three examinations will be undertaken in a sub-area of Comparative Social Organization.

- Comparative Social Organization: the sub-areas are: Comparative Societies, Comparative Institutions, Occupations and Formal Organizations, Social Stratification and Mobility, Social Anthropology.

The remaining comprehensive examinations must be undertaken in:

- Social Demography-Ecology, and/or
- Theory-Methodology

An approved field in a related discipline may be substituted for one of the areas listed above.

The comprehensive examinations are normally undertaken after completion of at least one year of Ph.D. study, and must be successfully completed at least one term before the oral defence of the thesis.

Language Requirements

The Department of Sociology and Anthropology requires each Ph.D. candidate to demonstrate an understanding of a language other than English. Although French is the preferred second language, students may be permitted to substitute another language if it is demonstrably relevant to their professional interests. It is strongly advised, however, that all English-speaking candidates be proficient in French. The language requirements may be satisfied by a demonstration of reasonable understanding, on sight, of material contained in selected samples of the sociological literature in that language. Students may find it necessary or advisable to take a course in the required language before undertaking the departmental language examination.

Academic Standing

Candidates must obtain a grade of B– or better in each course and on the comprehensive examinations.

Graduate Courses*

• Sociology 53.500F1
Traditional Theory: Marx and Simmel
The philosophical assumptions of Marx and Simmel. Treatment of Marx will include theories of ideology, class, politics and change. For Simmel concentration will be on interaction, conflict, personality, philosophical and formal sociology.
Prerequisite: Sociology 53.300 or equivalent.
Z.A. Jordan.

• Sociology 53.503W1
Social Action
A consideration of selected writings by M. Weber, G.H. Mead, E. Goffman, A. Schuetz, P. Berger, T. Luckman, and H. Garfinkel. The focus of this seminar is on the development of the concept and theory of social action as it was originally formulated by M. Weber and G.H. Mead and subsequently modified and applied by other writers.
G. Neuwirth.

• Anthropology 54.504T2
Ecological Anthropology
This course examines selected theoretical, methodological, and substantive issues, both historical and contemporary, in Ecological Anthropology. Special emphasis is given to problems of systems analysis, the epistemological status of ecological data and ecological explanation. Selected cases in North America and other ethnographic regions will be considered.

• Sociology 53.506F1
Theories of Social Organization and Change
The problem of order is examined in terms of alternative models dealing with continuity in social systems. In particular the relationship between value integration and conflict approaches is examined.
R. Crook.

• Anthropology 54.508T2
Structural Analysis and Formal Models
Theoretical and methodological problems in formal systems analysis such as behaviourist models in Anthropology, decision theory, exchange theory, and Structuralism are examined through a consideration of current issues in these areas.

• Sociology 53.509F1
Philosophy of Social Science I
The seminar considers the philosophy of language and the basic elements of scientific method, such as the classification of the sciences, the concepts of value, cause and probability, induction and deduction, confirmation of hypotheses, and the concept of truth.
Z.A. Jordan.

• Sociology 53.510W1
Philosophy of Social Science II
This seminar examines some important issues in the philosophy of science. Topics include: scientific laws, theory, explanation and prediction; conceptual frameworks; models, operational definitions and indicators; and the controversial nature of collective properties in the social sciences.
Prerequisite: Sociology 53.509.
Z.A. Jordan.

• Sociology 53.512F1
Statistical Methods I
Focus will be on research design and sampling designs. Various data-collecting methods will be examined and the strengths and weaknesses of various sample designs will be considered. The basic foundations of statistical analysis will be laid.

• Sociology 53.513W1
Statistical Methods II
Focus will be on advanced research methods. Topics will include: distributions, sampling distributions, hypothesis testing, and non-parametric methods. There will be an introduction to multivariate techniques including regression and log-linear models.

• Anthropology 54.516F1 (54.512)
North American Ethnography
Issues in traditional and contemporary problems in theory and method in North Ameri-

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

can ethnography. Ethnographic approaches to problems of social and cultural change are also considered. Ethnographic case materials, principally (but not exclusively) dealing with North American Indians and Eskimos, are emphasized.

• Anthropology 54.517W1 (54.513)
Sub-Saharan African Ethnography
Issues in traditional and contemporary ethnographic theory, method, and technique in Africa south of the Sahara. Ethnographic approaches to social and cultural change are also considered. Selected ethnographic regions of problems are emphasized from year to year.

• Sociology 53.520W1
Comparative Social Systems
The seminar explores both perspectives and research procedures employed by sociologists in the systematic and explicit comparison of data from two or more societies. Major emphasis is placed on theoretical and methodological issues in comparative research. Included among the topics for discussion are the following: the nature of sociological propositions in comparative research, the problem of conceptual equivalence, research designs and levels of analysis. Examples are drawn from both classical and contemporary comparative studies.
J. Harp.

• Sociology 53.521F1
Comparative Methods in Social Research
A seminar dealing with current analytical problems and applications of comparative methods in social research. Students are expected to participate in a group research project in which one or more of these methods will be applied.
J. de Vries.

• Anthropology 54.522W1
Economic Anthropology
Current theoretical and methodological problems and substantive issues in Economic Anthropology.

• Anthropology 54.523W1
Kinship Systems
An examination of current theoretical and methodological problems and substantive issues in the analysis of kinship systems, in both descent and alliance theory.

• Sociology 53.525T2
Canadian Society
A critical examination of sociological models of modern societies and their relevance to Canada. Special attention is given to current research and its application to contemporary issues.

• Sociology 53.526F1
Sociology of Occupations and Professions
A consideration of the development and occupational recruitment patterns and manpower problems in developed and developing areas.
B.A. McFarlane.

• Sociology 53.527F1
Sociology of Formal Organization
A consideration of the forms and processes of bureaucracy in modern society, government and industry.

• Sociology 53.531W1
Social Institutions II: Education
The seminar generally concentrates on some more particular topic within the larger field of the sociology of education: for example, the relations between education and other institutional orders, the structure of educational opportunity, educational systems and organizations, the sociology of learning.
S. Richer.

• Sociology 53.535F1
Sociology of Religion
This seminar concentrates upon the study of religious phenomena and systems as interpreted by classical and contemporary sociological theory. Four major topical areas are treated: the sociological interpretation of religion; religion as a social system; religion, society and social change; and religion and social science.
G. Irving.

• Anthropology 54.539W1
Political Anthropology
An examination of current theoretical and methodological problems and substantive issues in anthropological approaches to the study of power and authority, political behaviour, and political institutions.

• Sociology 53.540W1
Political Sociology
An examination of the sociological dimensions of power, politics, and political behaviour. Particular attention is placed upon class politics and the role of labour organizations in Canadian society.
D. Forcese.

• Sociology 53.545F1
Power and Stratification
An examination of theories of elite behavior, social class and ideology.
J. Porter.

• Sociology 53.550W1
National Unity in Multi-ethnic Societies
A critical examination of governmental multi-ethnic policies in a number of countries and the extent to which these policies promote or impede national unity.
V. Valentine.

• Sociology 53.560W1
Human Ecology
A discussion of the interrelationships among community, social organization and environment, with particular emphasis on technology, population and culture.

• Sociology 53.566F1
Contemporary Socio-Demographic Problems
A seminar which studies the interrelationships between social organization and fertility, mortality, and migration processes.

• Sociology 53.575W1
Workshop in Contemporary Macro-Sociological, Demographic and Ecological Problems
A workshop devoted to studying problems of implementing projects in the field of comparative social organization. Concentration is on Canada in a comparative context. Topics for 1976-77: The International Statistical Institute/ World Fertility Survey project.
I. Pool.

• Sociology 53.583F1
Departmental Seminar
Topic for 1976-77: Social Indicators.

• Sociology 53.585W1
Selected Topics in Sociology
Offered from time to time, depending upon the availability and interests of students and staff.

• Sociology 53.586W1
Selected Topics in Sociology
Topic for 1976-77: Sociology of Health.
H. Burshtyn and B. McFarlane.

• Anthropology 54.587W1
Selected Topics in Anthropology
Offered from time to time, depending upon the availability and interest of students and staff.

• Sociology 53.590F1, W1, S1
Tutorials

• Anthropology 54.590F1, W1, S1
Directed Readings

• Sociology 53.599F4, W4, S4
M.A. Thesis

• Anthropology 54.599F4, W4, S4
M.A. Thesis

• Sociology 53.600T2
Doctoral Seminar
An examination and review of the major areas of theory and research of departmental concern in the Ph.D. program. This course is required of all in-coming Ph.D. students in their first year of residence. Other Ph.D. students still in residence are strongly urged to participate in this seminar.

• Sociology 53.601F1
Selected Topics in Sociology

• Sociology 53.602W1
Selected Topics in Sociology
Topic for 1976-77: Popper and Kuhn.
Z.A. Jordan.

• Sociology 53.690F1, W1, S1
Tutorials

• Sociology 53.699F, W, S
Ph.D. Thesis

Courses not offered in 1976-77:
53.501 Traditional Theory: Durkheim and Weber

53.502 Contemporary Theory: Social Behaviourism
53.505 The Sociology of Knowledge
53.507 Theories of Social Change and Modernization
53.511 Multivariate Analysis
53.529 Sociology of Science and Technology (53.524)
53.530 Social Institutions I
54.536 Symbolic Systems
53.565 Demographic Analysis

The Institute

Director of the Institute: C.H. McMillan

The Institute of Soviet and East European Studies was established in 1970 to co-ordinate an M.A. degree program in interdisciplinary studies and research, conferences and publications in this field.

Participating in the M.A. program are specialists in the Soviet and East European field from the Departments of Political Science, History, Economics, Geography, Russian and Law, as well as invited specialists from other universities and visiting scholars from the USSR and Eastern Europe. The program is designed for students wishing to acquire specialized knowledge of the Soviet and East European area, including proficiency in Russian. The approach is interdisciplinary, with emphasis on the social sciences and history.

Qualifying Year Program

Applicants with a general (pass) Bachelor's degree with at least B– standing, in one of the disciplines represented in the program, may be admitted to a Qualifying Year program designed to raise their standing to Honours status. If successful, they may be permitted to proceed to the Master's program the following year.

To be eligible for admission to the Qualifying Year program, an applicant must have already taken some courses in the area of Soviet and East European studies so that by the end of the program, he should have satisfied the following requirements:

- a reading knowledge of Russian (the equivalent of three full courses in the Russian language beyond the introductory year);
- a total of seven full courses (or the equivalent) in the Soviet and East European field, taken in no less than three different departments;
- a minimum grade of B– in each of the courses comprising the Qualifying Year program.

Master of Arts

Admission Requirements

The normal requirement for admission into the Master's program is an Honours bachelor's degree (or the equivalent) in Soviet and East European Studies, with at least B– standing.

A reading knowledge of the Russian language is also required. In some cases the Institute may permit another Slavic or East European language to be substituted.

Graduates in other disciplines may be admitted but will be required to complete additional courses. In some cases candidates may be required to enter the Qualifying Year.

Program Requirements

The specific requirements in the Master's program are the following:

- Soviet Studies 55.500T2, Interdisciplinary Seminar on the Soviet Union and Eastern Europe;
- two full courses, or the equivalent, chosen from the following list, with at least one full course (or the equivalent) at the 500 level.

History

24.461 Selected Problems in Soviet History
24.560 Late Imperial and Revolutionary Russia

Political Science

47.431 Marxist Thought
47.432 Contemporary Communist Thought
47.461 Soviet Foreign Policy
47.514 Comparative Communist Politics; Theory and Practice
47.515 Comparative Communist Politics: Selected Aspects
47.516 Selected Problems in Soviet Politics
47.531 Selected Problems in the History of Political Thought

International Affairs

46.535 Integration in Eastern Europe
46.566 Problems in East-West Trade

Economics

43.370 Economics of Socialism
43.571 Comparative Economic Systems

Sociology
53.500 Seminar in Sociological Theory: Sociology of Marx

Geography
45.531 Selected Studies in the Human Geography of Arctic and Subarctic

Russian
36.430 Russian Realism of the 19th Century
36.440 Soviet Russian Drama
36.450 Contemporary Russian Literature (after 1935)
36.470 Modern Russian Literature

Law
51.488 Socialist Legal Systems
51.491 Directed Studies
51.520 International Economic Law I
51.521 International Economic Law II

- One of the following:

Soviet Studies
55.599 M.A. Thesis *or*
55.598 Research Essay *and* an additional full course (*or* the equivalent) chosen from among those listed above;
- an oral comprehensive examination to determine the candidate's general competence in the area and his ability to relate various disciplines to the study of the USSR and Eastern Europe;
- a working knowledge of the Russian language and, depending on the subject of the thesis, an additional Slavic or East European language.

Candidates are encouraged to undertake a minimum of six weeks of study at an educational institution in Eastern Europe or the Soviet Union, preferably during the spring term. Candidates are also encouraged to take a tutorial in one East European language other than Russian offered by the Department of Russian.

Academic Standing

Master's candidates must obtain a grade of B– on all work counted for credit towards the degree.

Graduate Courses*

- Soviet Studies 55.500T2
Interdisciplinary Seminar on the Soviet Union and Eastern Europe
The theme of the seminar varies from year to year, but the continuing objective is to apply the approaches and methods of several relevant disciplines. To the extent possible an attempt is made to give particular attention to disciplines and countries.

- Soviet Studies 55.590F1, W1, S1
Tutorials in Soviet and East European Studies
A course of directed readings in selected areas of Soviet and East European Studies, involving preparation of papers as the basis for discussion with the tutor.

- Soviet Studies 55.598F2, W2, S2
Research Essay
A research essay on some topic relating to the Soviet Union or Eastern Europe.

- Soviet Studies 55.599F4, W4, S4
M.A. Thesis

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Departmental Program Descriptions and Details of Courses

Faculty of Engineering

Dean: M.C. de Malherbe

Programs of study are offered by the Faculty of Engineering leading to the degrees of Master of Engineering and Doctor of Philosophy in Aeronautical, Civil, Electrical and Mechanical Engineering and to the degree of Master of Engineering in Materials Engineering.

The areas of current research, the research facilities available and the graduate courses offered are given in the following pages for the four departments of the faculty:

- Civil Engineering
- Mechanical and Aeronautical Engineering
- Systems Engineering
- Electronics

Although each candidate will pursue his studies and research within one of these departments, he is encouraged to take at least one half-course outside his department. Both the Master's and Doctoral programs may be undertaken on a full-time or part-time basis.

General information on awards and financial assistance is given in the awards and financial assistance section of this Calendar.

A limited number of students who are not degree candidates may be admitted to each graduate engineering course. Credit earned as a Special student normally cannot be counted towards the requirements of a graduate degree in Engineering.

Modular Courses

Some courses offered by the Faculty of Engineering are organized on a modular basis in which the course is subdivided into a number of instructional units of weights one, two, three or four. A full course has a total weight of eight, and a half-course a weight of four. Several courses may share a single module and care is exercised to ensure that modules of equal weight are academically equivalent. Periods of intensive instruction, correspondence work, projects, directed studies and audiovisual packages may be involved as well as the conventional lecturing formats, and the courses may extend over several terms. Further details are found in the course descriptions, and certain other courses, not so described, may be available in modular format.

Computing Facilities

The University has a central system with comprehensive facilities including a large number of timesharing terminals, remote job entry from the engineering building for batch, and a plotter and graphics. A large number of minicomputers including four with disc operating systems and interactive graphics are in use by the various engineering departments.

Special Research Arrangements

Research in an Outside Institution

A student may apply for permission to carry out his research, in part or whole, in an outside institution (e.g., industrial, governmental or university laboratory). Such an application, addressed to the Dean of Engineering, must:

- include a detailed statement of the research proposal, of arrangements for supervision and of the circumstances under which it is to be carried out;
- establish that the applicant will be able to pursue independent research;
- state the facilities available for the research;
- include a proposed time-schedule;
- be accompanied by a supporting letter from a responsible person in the outside institution giving approval of the proposal and accepting these regulations.

Part-time Thesis Research

A part-time research program may be permitted if the conditions for the "presence" of the student listed in a previous section are satisfied. It is the responsibility of the research supervisor to define the fraction of full-time research engaged upon by the student so that this can be appropriately credited to his program and assessed for payment of tuition fees. Before permission to undertake research on a part-time basis can be granted, the student must submit in writing, to the Dean of Engineering, a statement of his proposed manner of working part-time, supported by a letter of approval from his employer.

Master of Engineering

Admission Requirements

Applicants are admitted under the general regulations specified in this Calendar but in addition are required to have strong undergraduate preparation in the appropriate Engineering disciplines, computer programming, mathematics and physics.

Program Requirements

Two alternatives are available for full-time students studying towards the degree of Master of Engineering. One involves four half-courses in the first term, three half-courses in the second term and a thesis. The other involves four half-courses in each of three terms and does not involve a thesis. In both cases, the candidate must take at least two graduate level half-courses in Engineering in each term. Usually no undergraduate engineering courses may be taken for credit. Equivalent alternate programs will be arranged for part-time students. Choice of the alternative to be taken must be arranged and approved at the time of admission into the program.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of his thesis and related fields.

Full-time graduate students and part-time thesis students are required to attend departmental seminars held regularly to discuss current research and related topics. Each student must, of course, maintain a close working relationship with his supervisor and attend the courses in which he is registered. His supervisor may require him to submit written reports and to present seminars.

Thesis Regulations

The thesis must represent the result of the candidate's independent research or development work, undertaken after admission to graduate standing at Carleton University. Experimental or theoretical results previously published by the candidate may be used only as introductory or background material for the thesis. A candidate may be permitted to carry on thesis research work off-campus providing the work is approved in advance and arrangements have been made for supervision of thesis research activities by a faculty member of Carleton University. A part-time student may use the Faculty of Engineering laboratory facilities for on-campus thesis research and development activities.

Waiver of Thesis

A candidate for the Master's degree who has, before admission, completed independent research or development projects of an adequate level of accomplishment, may apply to the chairman of the department concerned for a waiver of the thesis requirement. Such application must be made at the time of initial registration and must be supported by copies of published reports describing the work. If the application is approved, the candidate must take ten half-courses or the equivalent, six or which must be graduate level courses in Engineering, to fulfill the requirement for the award of a degree without a thesis. A candidate who has been granted a waiver of the thesis requirement will be required to take an oral examination on the subject of one of his published papers and topics related to his field of specialization.

Transfer of Credit

Normally credit for one full graduate course completed at another university may be accepted in partial fulfilment of degree requirements, provided the course is appropriate to the candidate's program at Carleton. Under special circumstances a second full course may be allowed. Refer to the general regulations section of this Calendar for details of the rules governing transfer of credit.

Doctor of Philosophy

Admission Requirements

For admission to the Doctoral program, an applicant must normally hold a Master's degree in Engineering (or its equivalent) and, by his previous program of study and scholastic record, demonstrate a capacity for advanced study and research. Experience gained while working in an engineering or research environment will be

taken into account when assessing an application. The applicant must specify his intended field of research.

Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance and demonstrates high promise for advanced research during the full-time Master's program at Carleton may, subject to meeting the requirements below, be permitted to transfer into the Ph.D. program without receiving the Master's degree. Such a student must complete the course requirements and thesis registration requirements of the Master's program but is exempted from submission of the thesis.

A student wishing to transfer should apply to the chairman of the department. If the department and the Faculty of Graduate Studies and Research approve the application, he will be required to take the Comprehensive Examination for the Ph.D. The requirements for the Comprehensive Examination will then include the submission of a report on his research to date and a research proposal for the Ph.D.

After successfully passing the Comprehensive Examination, the student will be admitted to the Ph.D. program with normal program requirements (but with the Comprehensive Examination to his credit). If he is unsuccessful, he will remain in the Master's program and be required to submit his thesis in the usual way.

Program Requirements

The specific program requirements for the Ph.D. degree are the following:

- a minimum of two calendar years of full-time study (or the equivalent);
- course requirements as established on admission, but not less than six half-courses, or equivalent, in total. These requirements must include at least four graduate level half-courses in Engineering and at least one full course in an appropriate discipline outside the Faculty of Engineering;
- substantial research;
- a thesis on the research. Each candidate will be required to make an oral presentation of his thesis research and will be examined orally on the subject of his thesis and related fields.

All full-time graduate students and all part-time students actively engaged in research are required to attend departmental seminars held regularly to discuss current research and related topics. Each student is required from time to time to present a seminar on his research.

Each Ph.D. student (full-time or part-time) must obtain satisfactory grades in course work, must make satisfactory progress in the research, and must satisfy the following criteria of activity or "presence" in the program:

- maintain a close working relationship with the research supervisor;
- attend the courses for which he is registered;
- submit written reports and present seminars as required by his supervisor;
- attend departmental seminars;
- be readily available on an informal basis.

Advisory Committee

An advisory committee with at least three members will be appointed by the Department soon after a student's first registration. It has the responsibility of ensuring that conditions for the pursuit and completion of his program are fulfilled and reviews the student's progress at least once a year.

Comprehensive Examination

The comprehensive examination is held approximately one year after initial registration in the program in the case of full-time students, and at an equivalent time in the case of part-time students. The purpose of the examination is threefold:

- to assess the student's comprehensive knowledge of his field of study;
- to assess the preparedness and capability of the student for doctoral research;
- to judge the suitability of the research topic for a doctoral thesis.

The student is required to present his research proposal and be subjected to oral and written examination in appropriate fields of study. He will be informed by his Advisory Committee of the specific requirements of the examination. Having successfully completed the comprehensive examination, the student becomes a doctoral candidate.

Department of Civil Engineering

The Department

Chairman: D.A. Kasianchuk
Departmental Supervisor of Graduate Studies: Ata M. Khan

The Department of Civil Engineering offers programs of study and research leading to the Master's and Ph.D. degrees in Civil Engineering.

The Department conducts research and has developed graduate programs in three areas of Civil Engineering:

- Building Design and Construction
- Transportation Planning and Technology
- Soil Mechanics and Foundations

The graduate program in Building Design and Construction emphasizes the following fields: behaviour and design of steel, reinforced concrete, prestressed concrete, masonry, timber and aluminum structures; structural systems and design optimization; computer applications in structural analysis and design; integration of structural, mechanical and electrical building requirements as well as construction economics. In addition, courses offered by the Department of Civil Engineering at the University of Ottawa may be taken.

Laboratory facilities include a 400,000 lb. universal testing machine with auxiliary equipment for load and strain control; an Electro-Hydraulic Servo Controlled Testing System of 100,000 lb. dynamic capacity; a 10,000 lb. fatigue testing machine, specialized equipment for torsion and impact studies; advanced equipment for electric resistance strain gauge work; and a wide selection of other loading, measuring and recording equipment for testing structural materials and components. The concrete laboratory has facilities for the casting, curing and testing of reinforced concrete members.

Computer related equipment within the department comprises three terminals, including a computer storage scope display terminal, and a digitizing table. This equipment is interfaced to the SIGMA 9 computer in the University computer centre through telephone couplers. A library of computer programs for structural engineering is a significant resource for advanced study and research.

The graduate program in Transportation Planning and Technology deals with problems of policy, planning, design and operations in all modes of transportation. In the area of transportation planning, the focus is on the analysis and design of transport systems, modelling and simulation, urban and regional studies, traffic engineering, and geometric design. In the transportation technology area, programs deal with technology of vehicles and facilities, acoustics and noise, materials and pavement design.

The studies in Soil Mechanics and Foundations are directed primarily toward the theoretical analysis of soil-foundation interaction, soil plasticity and large deformation analysis of soil and rock masses. Broader programs in geotechnical engineering may be arranged making use of courses given in the Department of Geography and in the Civil Engineering Department of the University of Ottawa. The Soil Mechanics, Soil Dynamics and Highway Materials Laboratories provide facilities for studies of the physical properties of soil, stabilized soil, aggregate, and bituminous mixtures.

Master of Engineering

Admission Requirements

The normal requirements for admission to the Master's program are outlined in the Faculty of Engineering and general sections of this Calendar.

Program Requirements

The Master's program may be undertaken in one of the following optional patterns:

- by course work: 12 half-courses, including the project course Engineering 82.590;
- with thesis: normally seven half-courses and a thesis.

In either pattern, the program must be approved by the Department.

Please refer to the Faculty of Engineering section of the Calendar for details of the program requirements.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission to the doctoral program are outlined in the Faculty of Engineering section of this Calendar.

Program Requirements

The specific program requirements for the Ph.D. degree are listed in the Faculty of Engineering section of this Calendar.

The program for each candidate will be developed by his Advisory Committee and must be approved by the Department. The course work requirement for a candidate in Civil Engineering will normally consist of eight half-courses.

Graduate Courses*

• Engineering 82.511F1
Introductory Elasticity
Stress analysis involving plane stress, plane strain, plastic strain and displacements of isotropic homogeneous materials. Stress functions. Interference and rotational stress. Selected computer solutions.
C.R. Thompson.

• Engineering 82.512W1
Advanced Elasticity
Continuation of concepts of stress and strain and stress functions introduced in 82.511. Strain-Energy methods. Torsion-thermal stresses. Complex variable solutions. Computerized solutions.
Prerequisite: Engineering 82.511 or consent of instructor.
C.R. Thompson.

• Engineering 82.513F1
Finite Element Methods in Stress Analysis
Finite element theory and numerical methods. Constant strain triangles. Linear strain triangles. Reinforced triangles. Axi-symmetric shells. Axi-symmetric solids. Plates in bending. Throughout the course application to engineering problems is emphasized.

• Engineering 82.517F1
Experimental Stress Analysis
Introduction to theory of elasticity. Photoelasticity: types of polariscope, two and three dimensional stress fields, frozen patterns. Photoelastic coatings. Strain gauges; gauge factors sensitivity, calibration and temperature compensation. Moire fringes, brittle lacquers, mechanical strain gauges.
R. Bell.

• Engineering 82.522F1
Theory of Plates and Shells
Circular and rectangular plates with small deflections; introduction to large deflection theory of plates; membrane theory of shells; bending of shells of revolution and cylindrical shells.

• Engineering 82.523W1
Theory of Structural Stability
Elastic and inelastic behaviour of beam-columns; elastic and inelastic buckling of frames; application of energy methods to buckling problems; lateral-torsional buckling of columns and beams; buckling of plates; local buckling of columns and beams.
Prerequisite: Engineering 82.525 or equivalent.

• Engineering 82.524W1
Behaviour of Steel Structures
Steel as a structural material; bolted and welded connections; brittle fracture and fatigue; members subjected to combined bending and compression, and to twist and local buckling; structural stability of frames.
J.L. Humar.

• Engineering 82.525F1
Analysis of Elastic Structures
Application of matrices to structural analysis; force and displacement method of analysis for framed elastic planar and space structures; introduction to structural dynamics.
J.L. Humar.

• Engineering 82.526W1
Prestressed Concrete
General consideration of the aspects of de-

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

formation and fracture of concrete. Outline and scope of prestressed concrete design concepts. Flexural behaviour, shear, bond, prestress losses, end block design. Selected topics.
J.J. Salinas.

• Engineering 82.527W1
Advanced Structural Design
A number of topics such as structural form, aesthetics, load analysis, design in timber and masonry are treated by members of the department and outside consultants.
J. Adjeleian and G.T. Suter.

• Engineering 82.528F1
Advanced Reinforced Concrete
The research background, development, and limitations in current building code provisions for reinforced concrete; yield line theory of slabs; limit analysis of reinforced concrete structures.
G.A. Hartley.

• Engineering 82.529F1
Foundation Engineering - Case Histories
A critical study of consideration of case histories of current procedures of design and construction of foundations, earth retaining structures, and earth slopes.

• Engineering 82.530F1
Advanced Soil Mechanics I
Effective stress, pore pressure parameters, saturated and partially saturated soils; seepage; permeability tensor, solutions of the Laplace equation, elastic equilibrium; anisotropy, non-hemogeneity; consolidation theories; shear strength, cohesive and cohesionless soils.
A.P.S. Selvadurai.

• Engineering 82.531W1
Advanced Soil Mechanics II
Plasticity in soil mechanics, failure and yield criteria, plastic equilibrium, upper and lower bound solutions, uniqueness theorems, statically and kinematically admissible states; stability analysis of cohesive and cohesionless soils.
A.P.S. Selvadurai.

• Engineering 82.533W1
Pavement Design
An analysis of the interaction of materials, traffic and climate in the planning, design, construction, evaluation, maintenance and rehabilitation of highway and airport pavements.
D.A. Kasianchuk.

• Engineering 82.534F1
Transportation Planning I
Framework and process of transport planning. Modelling demand and supply of transport. Network analysis and simulation. Introduction to transport projects and systems evaluation.

• Engineering 82.535F1
Traffic Engineering I
Introduction to principles of traffic engineering. Basic characteristics of drivers, vehicles, and traffic. Volume, speed and delay studies. Traffic stream characteristics and queueing theory. Capacity analysis of roads and intersections. Safety.
J.P. Braaksma.

• Engineering 82.536F1
Highway Materials
Materials characterization and strength evaluation of soils, stabilized soils, aggregates, and asphalt concrete. Effects of low temperatures and frost on materials behaviour.
D.A. Kasianchuk.

• Engineering 82.537F1
Urban Transportation
Urban transportation systems planning and design. Urban development models - an introduction. Urban transportation policy.
J.C. Rae.

• Engineering 82.538W1
Geometric Design
Basic highway geometric design concepts. Vertical and horizontal alignment. Cross-sections. Interchange forms and design. Adaptability and spacing of interchanges. Design of operational flexibility, operational uniformity, and route continuity on freeways.
J.P. Braaksma.

• Engineering 82.539W1
Transportation Planning II
Advanced treatment of transport planning concepts and techniques. Transportation, urban and regional development interrelationship. Service analysis. Cost analysis and modelling. System synthesis. Investment planning. Evaluation of projects and systems and programming.

• Engineering 82.540W1
Traffic Engineering II
Theoretical techniques for describing traffic flow; empirical studies, hydrodynamic analogy, car-following concept, probabilistic description of traffic flow, queueing of traffic. Simulation in traffic engineering surveillance-control, network analysis.

• Engineering 82.541W1
Transportation Economics
Transportation economic analysis framework. Transport industry output. Carrier operations. Issues of resource utilization, measurement, economics of supply of infrastructure, pricing, subsidies, externalities. Transport policy in Canada.
K.W. Studnicki-Gizbert.

• Engineering 82.563W1
Computer-Aided Design of Building Structures
Relevant aspects of computer systems, information handling, auxiliary storage; design methods, computerized design systems; computer graphics; application of structural theory; examination of a selected series of structural engineering programs and programming systems.
W.E. Wright.

• Engineering 82.570F1
Special Topics in Building Design and Construction
Courses in special topics related to building design and construction, and not covered by other graduate courses, may be offered from time to time. Course details will be available some months prior to registration.

Topic for 1976-77: Engineered Masonry
Behaviour and Design Properties of brick, block, mortar, grout and steel. Testing, field control and inspection. Structural behaviour and design of plain and reinforced masonry walls, beams, and columns. High rise design and earthquake requirements.
G.T. Suter.

• Engineering 82.572W1
Special Topics in Geotechnical Engineering
Courses in special topics in geotechnical engineering and not covered by other graduate courses, may be offered from time to time. Course details will be available some months prior to registration.

• Engineering 82.574W1
Special Topics in Transportation Planning and Technology
Courses in special topics in transportation engineering and not covered by other graduate courses, may be offered from time to time. Course details will be available some months prior to registration.

• Engineering 82.590T2
Civil Engineering Project
Students enrolled in the M.Eng. program by course work will conduct an engineering study, analysis or design project under the general supervision of a member of the Department. Results will be given in the form of a written report and presented at a departmental seminar.

• Engineering 82.596F1, W1, S1
Directed Studies

• Engineering 82.599F3, W3, S3
M.Eng. Thesis

• Engineering 82.699F, W, S
Ph.D. Thesis

Other courses of particular interest to students in Civil Engineering include:

Mechanical and Aeronautical Engineering
88.509W1 Some Engineering Aspects of Air and Water Pollution
88.514W1 Ground Transportation Systems and Vehicles
88.521F1 Methods of Energy Conversion
88.550W1 Advanced Vibration Analysis
88.561W1 Design Theory and Practice
88.562F1 Failure Prevention
88.568F1 Deformation of Materials

Systems Engineering
94.501W1 Simulation and Modelling
94.515W1 Socio-Economic System Models
94.560F1 Engineering Methods in Numerical Analysis

Geography
45.415 Slope Development: Forms, Processes and Stability
45.416 Engineering Geomorphology
45.417 Glacial Geomorphology

45.532 Experimental Geomorphology
45.533 Periglacial Geomorphology
45.534 Aspects of Clay Mineralogy and Soil Chemistry
45.579 Research and Development in Recreational Geography

Mathematics
69.409 Mathematical Methods II

Civil Engineering, University of Ottawa
CVG 5100 Foundations
CVG 5101 Analysis of Stress and Strain in Rock Masses
Rock Masses
CVG 5104 Soil Testing and Properties
CVG 5105 Slope Stability
CVG 5106 Soil Engineering
CGV 5147 Theory of Plates
CVG 5148 Theory of Shells
CVG 5341 Finite Element Methods I
CVG 5349 Mine Waste Embankments

The Department

Chairman of the Department: A.R. Boothroyd

The Department of Electronics offers programs of study and research leading to the Master's degree and the Ph.D. degree in Electrical Engineering.

The graduate programs are directed towards study and research in the following interrelated fields:

Solid State Device Electronics
Semiconductor devices and integrated circuits; basic physical electronics; device modelling and computer aided design; device innovation.

Device Fabrication
Development of fabrication processes; bipolar and surface controlled devices; CCD's; integrated circuit realization of electron systems, special purpose devices for instrumentation; transducers.

Circuits and Circuit Theory
Active filter, linear and digital integrated circuit design, computer aided circuit design, subnanosecond TDR measurement techniques.

Microwave Electronics
Active and passive circuit and device techniques for communication and radar systems applications.

Radar Remote Sensing
Special purpose radar systems for ice thickness, water depth, soil moisture, archaeological and other applications; Ultra broadband antenna design and development.

Optics and Electromagnetics
CO_2 laser research, holography, remote measurement and interpretation of physical parameters, optical communications systems.

Technology of Analog Signal Processing
Solid state imagers, transversal filters, CCD delay lines, use in analog signal processing applications.

The structure of courses offered allows a well-integrated Master's or Ph.D. program of study to be chosen, appropriately related to the field of thesis research. Basic courses over semiconductor device theory, circuit and electromagnetic theory. Application-oriented courses include integrated circuit design, instrumentation techniques, microwave measurements and circuits, semiconductor device design and fabrication processing.

The research activity of the department is conducted mainly in the Solid State Device Laboratory and the Applied Instrumentation Laboratory.

The Applied Instrumentation Laboratory is concerned generally with measurement and instrumentation problems in the fields of communications, energy, transportation, agriculture and the manufacturing industries. Its activities range from research into basic aspects of measurement and instrumentation processes to the development of specific electronic instrumentation systems. Extensive collaboration is maintained with government and industrial research and development agencies in the Ottawa area.

Extensive facilities are available for the fabrication of solid state devices for research purposes. These include a laboratory in which processes required in silicon monolithic technology can be carried out under conditions of cleanliness and control comparable with those in industrial research laboratories. Among equipment items available are modern diffusion furnaces, an epitaxial reactor system, facilities for photolithography, vacuum system for thin film deposition, scribing, bonding and probing systems.

Well developed laboratory facilities exist for circuit work; also for holographic research and research in the laser field.

The Applied Instrumentation Laboratory possesses an extensive variety of general purpose laboratory instruments spanning the range from Dc to optical frequencies. In addition, the Laboratory has a number of sophisticated special purpose facilities such as network analyzer systems and dedicated computing systems.

Master of Engineering

Admission Requirements

The normal requirements for admission to the Master's program are outlined in the Faculty of Engineering and general sections of this Calendar.

Program Requirements

The Master's program may be undertaken in one of the following optional patterns:

- with thesis: normally seven half-courses and a thesis;
- by course work: 12 half-courses;

In either pattern, the program must be approved by the Department.

The non-thesis alternative for Master of Engineering is offered for both full-time and part-time students.

To be accepted for the program, full-time or part-time, a student must provide evidence of having had sufficient practical experience and of having attained a sufficient technical ability, since the Bachelor's degree. The applicant will be required to indicate his current level of engineering responsibility. Usually, at least two years of appropriate engineering experience will be required to qualify for entry to the program.

The course program for each student will be worked out on an individual basis by the student's faculty adviser and may include project courses involving laboratory work and/or directed studies courses.

The following courses are basic to the areas of study specified:

- Solid State Devices: *97.550*, 97.580, 97.558
- Microwaves: *97.551*, 97.562 or 97.589
- Circuits: *97.555*, 97.557

Students in electronics must normally take two of the italicized courses.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission to the Doctoral program are outlined in the Faculty of Engineering section of this Calendar.

Program Requirements

The specific program requirements for the Ph.D. degree are listed in the Faculty of Engineering section of this Calendar. Normally six half-courses are required.

The program for each candidate will be developed by his Advisory Committee and must be approved by the Department.

Graduate Courses*

- Engineering 97.550F1

Physics of Semiconductor Materials and Devices

The fundamental physics of semi-conductor devices is treated. Topics include band concepts, thermostatics of semiconductors, detailed statistics of semiconductors, quasi-Fermi levels and recombination kinetics, trapping processes, transport, surface physics.

M.A. Copeland.

- Engineering 97.551F1

Applied Electromagnetic Theory and Microwave Circuits

This course deals with circuit aspects of passive microwave components and systems with emphasis on concepts employed in the design and use of microwave devices. Topics treated include transmission lines and waveguides, basic microwave network analysis, and properties of waveguide and transmission line junctions. The design, characteristics, and use of microwave components such as transformers, filters, hybrids, tuners, and directional couplers are discussed in detail.

A.L. Van Koughnett.

- Engineering 97.552F1, W1, S1

Studies in Electronics

A course of study designed to satisfy the individual needs of students wishing to pursue studies in Electronics beyond the scope of the regular courses offered. It can consist of parts

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of regular courses, project tasks and directed study, in any combination. The intent is to provide for studies in new areas, or on topics which cut across existing course offerings. The details of the course are worked out by the student's adviser or research supervisor and must be approved by the Chairman of the department.

• Engineering 97.555F1
Passive Circuit Theory
General description of networks leading to matrix representation of n-terminal lumped and distributed networks. Elements of matrix algebra as applied to networks. Properties of network functions; poles and zeros of driving point and transfer functions. Foster and Cauer canonic forms. Synthesis of lossless 2-ports; single and double-terminated. Modern filter theory; approximation of characteristics by rational functions; Butterworth and Chebyshev approximations.
J.P. Knight.

• Engineering 97.557W1
Active Circuit Theory
Characterization of negative resistance 1-port networks; signal generation and amplification. Active 2-ports; y, z, h, k, chain and scattering parameters. Measurement of 2-port parameters. Activity and passivity; reciprocity, non-reciprocity and anti-reciprocity. Gyrator as a circuit element. Stability, inherent and conditional; power gain of conjugate and mismatched 2-port amplifiers. Amplifier gain sensitivity. Oscillators, maximal loading and frequency sensitivity. Active filter design; gyrator, negative immittance convertor (NIC) and operational amplifier used as functional elements. Practical realization of gyrators and NIC's. Active network synthesis.
Prerequisite: Engineering 97.555 or equivalent.
P.D. van der Puije.

• Engineering 97.558W1
Surface-Controlled and Special Purpose Semiconductor Devices
Review of the theory of semiconductor surfaces and interfaces. Surface characterization. Study of surface dependent devices: MIS capacitors, gate controlled (field plate) diodes, MIS transistors. MIS memory elements, metal-semiconductor contacts. Complementary MOS transistors. Charge-coupled devices. Schottky barrier devices. Fast bipolar transistors with shallow junctions. Lateral transistor. Surface recombination. Special devices.
Prerequisite: Engineering 96.580 or equivalent.
R.E. Thomas.

• Engineering 97.559F1
Solid State Devices Fabrication Technology
Processes used in fabrication of silicon planar devices and integrated circuits. Crystal growth, epitaxy, thermal oxidation, solid state diffusion, vacuum processes, photolithography. Characterization and limitation of processes. Design consideration for discrete devices and integrated circuits. Methods of material, process and device assessment. Thin film technology. Ion implantation.
R.E. Thomas.

• Engineering 97.562F1
Microwave Solid State Electronics
Discussion of basic principles of operation of varactor diodes, p-i-n diodes, microwave switches, limiters and phase shifters, Schottky barrier devices, detector and mixer diodes, avalanche transit-time microwave diodes and bulk gallium arsenide devices.
V. Makios.

• Engineering 94.563W1
Communications Technology
Current engineering practice in communications systems design. The performance and interconnection of sub-systems which make up multichannel transmitters and receivers. Topics to be discussed include modulation, multiplexing, solid state microwave signal sources and amplifiers, transmission systems and receivers. This course is offered jointly by the Department of Electronics and the Department of Systems Engineering.
Prerequisite: Engineering 94.553 or equivalent experience.
D.R. Conn.

• Engineering 97.564W1
Advanced Instrumentation Techniques
The study and design of electronic systems for industrial and earth resource non-contacting measurement applications. Emphasis will be on the physical and mathematical modelling

of the parameters and materials of interest in addition to the synthesis of measurement systems. Possible topics include systems for high accuracy material thickness determination, range and velocity resolution, object detection, intrusion detection, moisture content determination, geophysical applications, and other topics selected from the current literature. Particular attention will be given to RF, microwave, and radar techniques. The course will be on a seminar basis and students will have the opportunity to make presentations on mutually acceptable topics.
W.J. Chudobiak.

• Engineering 97.565F1
Optical Communications
Transmission characteristics of optical waveguides; electroluminescent sources such as light emitting diodes, gallium arsenide lasers and gas lasers; photo-diodes, avalanche detectors; external beam modulators; repeater design; coupling devices for fibers; noise generation and measurements; inter-modulation, cross-modulation and non-linearity characterization; analog systems, digital systems, system design accounting for component signal degradation; free-space links; data bus systems; introduction to integrated optics.
G.D. Cormack.

• Engineering 97.580F1
Theory of Semiconductor Devices
Review of solid state physics underlying device mechanisms. Equilibrium and non-equilibrium conditions in a semiconductor. Physical theory of basic semiconductor device structures and aspects of design: PN junctions and bipolar transistors. Charge control theory. Modelling of device mechanisms. Large and small signal models of bipolar transistors. Performance limitations of transistors.
A.R. Boothroyd.

• Engineering 97.581F1
Electronic Circuit Reliability
The course is concerned with basic considerations in electronic circuit reliability, with particular reference to integrated circuits and LSI. Introduction to reliability statistics. Probability density distribution functions. Failure analysis, Determination of Confidence Limits, risk, MTBF, MTTF, Estimators, the Bathub Curve. Reliability Assurance. Reliability Physics. Failure Causes, modes, and mechanisms in semiconductor devices and I.C.s Reaction Kinetics, Reliability testing of Circuits. Environmental screen tests. Burn-in. Life tests. Electrical Testing. Functional Testing. Cost Considerations. Advanced Failure Analysis tests for I.C.s (for example SEM, X-Ray Microprobe Ion probe). Semiconductor test structures.
V. Sulway.

• Engineering 97.582W1
Coherent Electromagnetic Theory and Optics
Topics treated: analysis of two-dimensional linear systems, scalar diffraction theory, Fresnel and Fraunhofer diffraction. Fourier transforming and imaging properties of lenses, frequency analysis of optical imaging systems, spatial filtering and optical information processing. Relevance to communication theory, laboratory demonstrations of holography.
V. Makios.

• Engineering 97.584F1
Integrated Circuit Design
A course aimed at the engineer interested in basic Integrated Circuit design and realization. Design and realization of (a) simple I.C.'s and (b) cells (function blocks). Current technologies treated from processing standpoint—Bipolar, P-Channel MOS, n-channel MOS, CMOS. Devices realizable in each technology. Design rules. Mask layout and realization—Use of Computer aids. Linear function design and realization. Static and dynamic logic cell design and realization in bipolar, MOS and CMOS technologies. Computer analysis programs—importance to I.C. design. Modelling of I.C. elements and cells. I.C. testing and reliability considerations.
D.M. Caughey.

• Engineering 97.585W1
Modern Integrated Circuit Systems
A course aimed at the engineer involved in system design either in custom LSI form, or using off-the-shelf integrated circuits. Realization of sequential circuits - SSI/MSI, ROM, microprocessor with ROM, PLA. Study of systems organization on the IC chip - ROM, PROM, RAM, PLA, calculator chips. LSI

partitioning. Circuit aspects of static and dynamic MOS LSI logic and shift registers. Multiplexing. Clocking systems. Capacitive power and chip output problems. Charge transfer systems (CCD's), digital and analog, including filters and imaging arrays.
M.A. Copeland.

• Engineering 97.586W1
Computer-Aided Circuit Design
The course will be concerned with the application of computer methods in circuit analysis and design. Topics will include matrix analysis, topological methods, state space techniques, numerical analysis, modelling of solid state devices, optimization techniques. The second part of the course will include special topics, non-linear circuits, computerized filter design and computerized layout.
J.P. Knight.

• Engineering 97.587W1
Microprocessor Electronics
Basic elements of a microprocessor system, typical organization considerations of the LSI chip design, fabrication technology, cost and performance, comparison of the available alternatives. Study of example applications. Constraints imposed by the microprocessor on design of interacting integrated circuits, A/D converters, sensors and transducers. I/O problems.
J.P. Knight.

• Engineering 97.589F1, W1
Advanced Topics in Electronics
A course dealing with selected advanced topics of recent interest in the broad field of solid state devices, electronic circuits and electromagnetics. Specified topics to be announced each year. Course usually given on a seminar basis with students' presentations on assigned topics.

Topic for 1976-77: Microwave Measurement Techniques
A course dealing with modern microwave laboratory practice. Topics include cw swept techniques, pulsed techniques, cables, connectors, power measurements with crystal detectors and bolometers, directional detectors and mixers, noise measurement and general purpose instrumentation. Treated are: signal flow graph analysis, S parameter analysis, group delay, cross talk, $\omega(\beta)$ diagram, Rieke diagram and non-linear characteristics of mixers and frequency converters.
D.R. Conn.

• Engineering 97.590F1, W1, S1
Engineering Project
Project for students pursuing the non-Thesis M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented at a departmental seminar.

• Engineering 97.596F1, W1, S1
Directed Studies
Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above listed course topics where they are not offered on a formal basis.

• Engineering 97.599F3, W3, S3
M.Eng. Thesis

• Engineering 97.699F, W, S
Ph.D. Thesis

Other Courses

Of particular interest to students in Electronics are the courses offered by the Department of Systems Engineering.

Department of Mechanical and Aeronautical Engineering

The Department

Chairman of the Department:
H.I.H. Saravanamuttoo
Departmental Supervisor of Graduate Studies:
R.J. Kind

The Department of Mechanical and Aeronautical Engineering offers programs of study and research leading to M.Eng. degrees in Aeronautical Engineering, Materials Engineering and Mechanical Engineering, and to Ph.D. degrees in Aeronautical Engineering and Mechanical Engineering. The M.Eng. degree can be earned by a combination of course work and thesis or by course work alone.

Programs of research and study can be offered in the three broad areas of Thermofluid-dynamics, Mechanical Analysis and Design, and Materials. Courses are available in the particular fields of:

- Aerodynamics
- Internal Gas Dynamics
- Heat Transfer
- Noise and Aero-Acoustics
- Stress and Failure Analysis
- Vibration Analysis
- Engineering Design
- Material Properties
- Material Processing
- Vehicle Engineering
- Nuclear Engineering
- Energy Conversion and Utilization
- Energy Systems Planning
- Air and Water Pollution

The departmental research activities are focussed on several areas of technology where some of the above fields interact. Programs of study and research may be chosen in one or two of the fields above, or in one of these areas of technology.

The Department has a major research commitment, both analytical and experimental, to thermofluid-dynamic and mechanical problems of gas turbine engine design and operation. Current projects include: flow prediction and analysis in turbomachines; two and three dimensional boundary layer behaviour; dynamics of gas turbine power plants; design and performance of highly loaded turbines; heat transfer in air cooled turbine blades; noise generation in fans, compressors and turbines; noise propagation in acoustically treated ducts; stress, deformation and vibration of compressor and turbine blades and discs; optimum design of blades and discs; finite element analysis; dynamics of high speed rotors; electron beam welding of refractory metals; failure modes of materials in extreme environments.

As part of the faculty interest in transportation, the department is active in research on air and ground vehicle technology. Current studies include: vortex-wake generation by large aircraft; aircraft noise; boundary layer separation and control; model simulation of snow drifting on airports and roadways; optimization of off-road vehicle design; vehicle-terrain interaction; effect of vibration on vehicle performance; dynamics of air-cushioned and magnetically levitated vehicles; composite material structural elements.

Applied heat transfer research is concentrated in two main areas. One is the study of mixing and heat transfer problems in nuclear power reactors. The other involves the computer simulation of the performance of building environmental control systems with a view to minimizing energy consumption.

Department members provide the nucleus of the Carleton University Energy Research Group, which also includes members of the Department of Economics and which is engaged in interdisciplinary studies on the effectiveness of energy utilization in industrialized societies. In particular, studies are being undertaken on the optimization of nuclear reactor power plants for energy utilization, on energy utilization in transportation, in buildings and in industry and on the effects of price on energy supply and demand. A related interest in the Department is in air and water pollution problems associated with energy utilization.

A new venture for the Department is a course-oriented program in the area of energy systems planning, whose objective is to provide energy systems decision-makers with the educational background required to make the most appropriate choices for their situations.

Another area of interest of the Department is in materials and fabrication technology. In particular there is a considerable effort in welding metallurgy techniques and in the design of welded structures. In addition the general area of fracture mechanics and defect design techniques is developing and is applied both to design and materials evaluation. Facilities in this area include an electron beam system, an electron microscope and associated analytical facilities and fracture mechanics testing equipment.

The departmental laboratories are well equipped for the various research activities described above, and these are supported by a machine shop and electronics shop. In addition to the extensive laboratory facilities, the faculty maintains several small computers. The University Xerox Data Systems twin Sigma 9 computer facility is also used for major computations and is accessible at a large number of remote terminals in the Engineering Building.

The extensive laboratory facilities of the National Research Council and of the Department of Energy, Mines and Resources are also used, by special arrangement, for research and graduate studies of mutual interest. Strong contacts are maintained with the gas turbine and nuclear power industries.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission to the doctoral program are outlined in the Faculty of Engineering section of this Calendar.

Program Requirements

The specific program requirements for the Ph.D. degree are listed in the Faculty of Engineering section of this Calendar.

The program for each candidate will be developed by his Advisory Committee and must be approved by the Department.

Master of Engineering

Admission Requirements

The normal requirements for admission to the Master's program are outlined in the Faculty of Engineering and general sections of this Calendar.

Program Requirements

The Master's program may be undertaken in one of the following optional patterns:

- by course work: 12 half-courses;
- with thesis: normally seven half-courses and a thesis.

In either pattern, the program must be approved by the Department.

The course work Master's program in either Mechanical or Aeronautical Engineering is intended for students whose career objectives are best satisfied by a somewhat broader extension of their engineering background knowledge than that offered by a more specialized research program. The course of study will be tailored to suit the career objectives of each student individually, and must show depth of study in more than one field.

The ability to do significant work in Engineering without detailed supervision is an essential attribute for a holder of a Master's degree. Therefore one full course of the program is specified to be 88.572, Independent Engineering Study.

The following course requirements must normally be met for the degree. A total of six full courses or equivalent, of which:

- at least one full course or equivalent must be in an area of engineering outside the main field of study;
- one full course shall be an independent study (88.572);
- at least one half-course must be an approved advanced level Mathematics, Physics or Chemistry course.

Graduate Courses*

• Engineering 88.501F1
Theory of Viscous and Turbulent Flows
Navier-Stokes and boundary layer equations; mean flow equations for turbulent kinetic energy; integral formulations. Stability, transition, turbulence, Reynolds stresses; separation. Calculation methods, closure schemes. Compressibility, heat transfer and three-dimensional effects.
D.J. Peake.

• Engineering 88.502T2
Hypersonic Flow
Basic equations of inviscid, unsteady hypersonic flow. Small disturbance theory. Newtonian theory. Optimum body shapes. Blunt body theory. Hypersonic flow past oscillatory wedges and cones. Hypersonic boundary layers.
P. Mandl.

• Engineering 88.503F1
Incompressible Non-viscous Flow
The fundamental equations for non-viscous fluid flow; solution of two-dimensional and axisymmetric potential flows; low-speed airfoil and cascade theory; wing lifting-line theory.
R.J. Kind.

• Engineering 88.504W1
Compressible Non-viscous Flow
Steady isentropic, frictional and diabatic flow; shock waves; irrotational compressible flow, small perturbation theory and similarity rules; second-order theory; unsteady one-dimensional flow.
A.N. Abdelhamid.

• Engineering 88.505W1
Aerodynamics of Wings and Bodies
Numerical methods for calculation of aerodynamic forces on airfoils, wings and bodies. Aerodynamic influence coefficients; method of boxes; collocation method; interference; unsteady aerodynamics. Basic concepts of several related computer programs and their application.

• Engineering 88.508W1
Experimental Methods in Fluid Mechanics
Fundamentals of techniques of simulation of fluid dynamic phenomena. Theoretical basis, principles of design, performance and instrumentation of ground test facilities. Applications to: aerodynamic testing (subsonic to hypersonic speeds); wind effects on structures; air and water pollution.
J. Lukasiewicz and others.

• Engineering 88.509W1
Some Engineering Aspects of Air and Water Pollution
Characteristics of major pollutant sources. The atmosphere: stratification and stability, equations of motion, winds, mean flow and turbulent diffusion near the earth's surface. Motion and diffusion in lakes, rivers and ground-water flows. Techniques for analysis and model simulation of pollutant dispersion. Principles of devices for pollutant removal.
R.J. Kind.

• Engineering 88.510W1
Performance and Economics of V/STOL Aircraft
Aircraft performance analysis with emphasis on factors affecting take-off, landing and economic performance. High lift schemes. Direct and indirect operating costs; route analysis and operational problems.
R.J. Kind.

• Engineering 88.511F1
Dynamics and Aerodynamics of Low Speed Flight
Brief review of static stability theory. Euler's equations for rigid body motion; the linearized equations of motion; stability derivatives and their estimation. Longitudinal and lateral dynamic response of an aircraft to control and disturbance.

• Engineering 88.513F1
Structural Dynamics and Aeroelasticity
Review of string and beam vibrations. Vibrations of membranes and plates. Theory of normal modes and solution by normal mode

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

expansions. Fourier transform methods. Matrix methods and finite element techniques. Vibration of built-up bodies, multi-bay panels, complete aircraft. Introduction to flutter.

• Engineering 88.514W1
Ground Transportation Systems and Vehicles.
Performance characteristics, handling and directional stability, ride comfort and safety of various types of ground vehicle systems, including road vehicles, terrain-vehicle systems, guided transport systems and advanced ground transport technology.
J.Y. Wong.

• Engineering 88.520W1
Electric Utility Systems Analysis
Topics covered will include: System size and growth, unit sizes, load flows, load-duration curves, load shedding, transmission limits and stability, site selection, economic considerations, reliability and reserve requirements.
J.T. Rogers.

• Engineering 88.521W1
Methods of Energy Conversion
The course covers technical, economic and environmental aspects of developing methods of energy conversion, as applied to large-scale systems. Among topics included are: fuel cells, MHD, fusion, solar energy, wind, geo-thermal and tidal energy.
J.T. Rogers.

• Engineering 88.522F1
Radiation Hazards and Reactor Safety
Topics covered include: radiation and biological effects, exposure limits and regulations, safety philosophy in reactor design, containment, probabilities and consequences of accidents and radioactive waste handling.
J.T. Rogers.

• Engineering 88.523W1
Environmental and Social Impact of Energy Conversion
Environmental impact of electric energy generation, including resource exploitation: atmospheric pollution, thermal pollution, radioactivity, land use. Societal attitudes to electrical energy generation and use.
J.T. Rogers.

• Engineering 88.524T1
Seminars in Electric Utility Systems Engineering
Seminars by faculty members and invited lecturers on problems in electric utility systems planning and modern decision-making techniques for coping with the problems. Field trips will be included.
J.T. Rogers.

• Engineering 88.530F1
Acoustics and Noise
Fundamentals of vibrations of solids and fluids; plane waves, spherical waves. Transmission and reflection; acoustic impedance and matching. Resonators and filters. Absorption in fluids. Introduction to acoustic measurements; loudspeakers, microphones. Introduction to area acoustics and jet noise.
A.N. Abdelhamid.

• Engineering 88.531W1
Aero-acoustics
Acoustic wave motion, the wave equation and solutions, acoustic impedance. Acoustic transmission; ducts, tubes; standing waves. Theory of jet noise; turbomachinery noise; noise suppression.
A.N. Abdelhamid.

• Engineering 88.541W1
Turbomachinery
This course deals with the generalized performance of turbomachinery, and with the thermo- and aerodynamic design of axial and radial flow machines. The emphasis is on compressible flow machines.
D.A.J. Millar.

• Engineering 88.542F1
Gas Turbines
Inter-relationship between thermodynamic, aerodynamic, mechanical design. Ideal and real cycle calculations. Cycle optimization; turboshaft, turbojet, turbofan. Component performance. Off-design performance; matching of compressor, turbine, nozzle. Twin-spool matching.
H.I.H. Saravanamuttoo.

• Engineering 88.543F1
Advanced Thermodynamics
The course covers three major topics: Review of Fundamentals from a Consistent Viewpoint, Properties and Equations of State and Applications and Special Topics. The third topic includes an introduction to Statistical Thermodynamics.
J.T. Rogers.

• Engineering 88.547F1
Conductive and Radiative Heat Transfer
Analytical, numerical and analog solutions to steady-state and transient conduction heat transfer in multi-dimensional systems. Radiative heat exchange between black, gray, non-gray diffusive and specular surfaces including effects of athermanous media.

• Engineering 88.548W1
Convective Heat and Mass Transfer
Conservation of momentum, heat and mass in boundary layers. Analogy between momentum and heat and mass transfer for laminar and turbulent, internal and external flows. Effects of free convection, variable properties, high velocities.

• Engineering 88.549W1
Two-Phase Flow and Heat Transfer
Topics covered include basic equations of liquid-vapor and liquid-gas flows including choked flows and flow oscillations, heat transfer rates and critical heat fluxes. Applications to practical problems are emphasized.
J.T. Rogers.

• Engineering 88.550W1
Advanced Vibration Analysis
General theory of discrete multi-degree-of-freedom vibrating systems. Emphasis on numerical techniques of solving complex vibrating systems with selected applications from aeronautical, civil and mechanical engineering.
J. Kirkhope.

• Engineering 88.561W1
Design Theory and Practice (Creative Problem Solving)
This course outlines problem-solving processes and how they can be applied in engineering design. The student will be introduced to and be expected to practice various systematic and creative problem-solving techniques. The emphasis is on the student's learning methodologies rather than accumulating information. The techniques may be successfully applied in any engineering specialty.
G. Kardos.

• Engineering 88.562F1
Failure Prevention (Fracture Mechanics and Fatigue)
The course deals with the design of engineering structures to ensure against failure due to fatigue or brittle fracture. It emphasizes an understanding of the nature of fatigue and brittle fracture and thereby the selection of suitable material, geometry and inspection procedures for the load and environmental condition intended.
G. Kardos.

• Engineering 88.566F1
Introduction to Modern Materials Analysis
The theory of x-ray and electron diffraction is applied to the analysis of the size, shape, distribution, crystal structure, stress, orientation and perfection of the phases present in engineering materials.
J. Goldak.

• Engineering 88.567W1
Special Topics in Materials Engineering I (Fracture of Structural Materials)
Fracture mechanics, fracture toughness testing. Microscopic aspects of plastic deformation, crack nucleation and propagation under static and cyclic loading. The physical meaning of fracture toughness.
J. Goldak.

• Engineering 88.568F1
Deformation of Materials
Elastic and anelastic properties of materials, internal friction, thermo-elasticity. Plastic deformation: dislocation mechanics, strain hardening, Bauschinger effects. Yielding criteria, deformation and slip field theory. Fracture phenomena. Viscoelastic deformation.
M.J. Bibby.

• Engineering 88.569W1
Special Topics in Materials Engineering II (Welding Metallurgy)
The metallurgical structure of the fusion zones and heat affected zones is related to the mechanical properties and welding parameters of welded joints. The course emphasis is on high strength low alloy steels.
M.J. Bibby.

• Engineering 88.570T1
Special Topics in Mechanical and Aeronautical Engineering
Courses in special topics related to Mechanical Engineering and Aeronautical Engineering, and not covered by other graduate courses, may be offered from time to time. Course details will be available some months prior to registration.
R.J. Kind and others.

• Engineering 88.571T1
Advanced Topics in Mechanical and Aeronautical Engineering
Courses in advanced specialized topics related to Mechanical Engineering and Aeronautical Engineering, and not covered by other graduate courses, may be offered. Such courses will normally be given only to doctoral level students. Course details will be available some months prior to registration.
R.J. Kind and others.

• Engineering 88.572T2
Independent Engineering Study
In this course, the student pursuing a Master's degree by course work will carry out an independent study, analysis and solution of an engineering problem or design project. The results will be given in the form of a written report and presented at a departmental seminar. The study will be carried out under the general direction of a faculty member.
R.J. Kind and others.

• Engineering 88.596F1, W1, S1
Directed Studies

• Engineering 88.599F3, W3, S3
M.Eng. Thesis

• Engineering 88.699F, W, S
Ph.D. Thesis

Other courses of particular interest include:

Civil Engineering
82.511 Introductory Elasticity
82.512 Advanced Elasticity
82.513 Finite Element Methods in Stress Analysis
82.517 Experimental Stress Analysis
82.534 Transportation Planning I

Systems Engineering
94.553 Stochastic Processes
94.560 Methods for Engineering Applications of Digital Computers

Department of Physics
75.447 Statistical Physics (Statistical Thermodynamics)

Department of Mathematics
70.446 Hydrodynamics
70.543 Mathematical Methods in Fluid Dynamics

Department of Mechanical Engineering, University of Ottawa
MCG 5112 Rarefied Gas Dynamics
MCG 5126 Properties of Materials at Low Temperatures
MCG 5127 Advanced Production Planning and Control
MCG 5128 Industrial Organization
MCG 5135 Geothermal Energy Exchange
MCG 4128 Basic Nuclear Engineering
MCG 5166 Nuclear Engineering Fundamentals
MCG 5167 Nuclear Reactor Engineering
MCG 5172 Special Topics in Systems Engineering
MCG 5191 Combustion

Department of Systems Engineering

The Department

Chairman of the Department: D.C. Coll

The Department of Systems Engineering offers programs of study and research leading to the Master's and Ph.D. degrees in Electrical Engineering and Mechanical Engineering.

The Departmental program centers upon the analysis and design of systems whose primary function is the processing of information. Within this context, four interrelated areas of study receive major attention:

- Computer Communications and Data Base Systems
- Communications and Signal Processing
- Computer Systems Engineering
- Modelling, Simulation, Optimization and Control

An integrated course program provides students with the fundamental basics and allows specialization in one or more of the above areas as desired. The research program emphasizes the development and application of modern methods of information systems engineering pertinent to these areas. Work undertaken includes both theoretical studies and the related problems of practicable realizations. Specific research topics are often associated with one or more major projects, such as the Wired City Simulation Laboratory, the Transparent Intelligent Network, and Speech Research Group.

Computing systems play a central role in the research and teaching activities of the Department. The facilities available to the student include interactive time-sharing and remote batch terminals linked to the university's Xerox Sigma-9 digital computer and several small to medium sized computers available within the Department. These include a PDP-15 with interactive graphics, a PDP-11/45, a GT-44, and GT-40 computer, both with graphics capability. Also available are a number of PDP-8 computers and several microprocessors systems. Applications include information storage and retrieval, speech processing, image processing/communications, and studies of man-machine communications.

Full advantage is taken within the Department of the technology-oriented government/industry/university complex in the Ottawa area. Cooperative projects exist with the Department of Communications, Communications Research Centre, the National Research Council, Bell Northern Research Laboratories, Canadian Radio Television Commission and the Ministry of State for Urban Affairs.

During the 1976-77 academic year, the Department will be exchanging courses with Stanford University via the Communications Technology Satellite, through which it will be possible for Carleton students to take the courses offered by Stanford University. Information regarding the available courses may be obtained from the Department.

Applicants who have an Honours degree or the equivalent in such areas as Computer Science, Mathematics, Operations Research, Psychology, Econometrics or Management Science and who would thus not qualify for admission to graduate studies in Engineering under the general regulations and yet who wish to study within the Department should take note of the joint Mathematics/Systems Engineering Program in Information and Systems Science.

Students wishing to pursue a Computing specialization in Systems Engineering may be required to take appropriate undergraduate Computing Science courses for which credit may be allowed.

Master of Engineering

Admission Requirements

The normal requirements for admission to the Master's program are outlined in the Faculty of Engineering and general sections of this Calendar.

Program Requirements

Two options are available for the Master's program:

- Thesis program, normally comprising seven half-courses and a thesis;
- Non-thesis program, comprising 12 half-courses, and including project course Engineering 94.590.

Certain courses are fundamental to advanced study in the various departmental areas of specialization. These are Engineering 94.552; 94.553; 94.557; 94.574. All M.Eng. students in Systems Engineering must complete at least two of these (but may complete more than two if they wish). The most suitable combination of these core courses should be chosen by the student in consultation with his program adviser at the time of initial registration. Students who lack a strong background in computing, but wish to concentrate on software engineering at the graduate level, may substitute the undergraduate combination 94.480 Introduction to Software Engineering and 94.481 Software Engineering Project in place of 94.574; in such a case, this undergraduate combination counts as one graduate half-course.

No more than two of 94.501, 94.502, 94.560, and 94.504 can be counted for program credit in the thesis option.

Information and Systems Science Program

This is a program administered jointly by the Department of Mathematics and the Department of Systems Engineering which leads to an M.Eng. (Electrical Engineering) or M.Sc. (Mathematics). It allows qualified applicants to study in the areas of information systems engineering, communications and signal processing, computing science, or mathematical systems theory.

Applicants who desire admission to the Information and Systems Science Program are required to have an Honour's degree in a related discipline, with at least three years of Mathematics and a strong undergraduate preparation in Computer Science; otherwise the general regulations apply. The normal program consists of eight half-courses of which two must be taken in the Department of Mathematics, and a thesis.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission to the Doctoral program are outlined in the Faculty of Engineering section of this Calendar.

Program Requirements

The specific program requirements for the Ph.D. degree are listed in the Faculty of Engineering section of this Calendar.

The program for each candidate will be developed by his Advisory Committee and must be approved by the Department.

Graduate Courses*

• Engineering 94.501W1
Simulation and Modelling
This course introduces the concept of simulation of both continuous and discrete processes, with emphasis on the latter. Model building for engineering, economic and sociological systems. Continuous time systems: analogue models, digital approximations; continuous simulation languages. Simulation of discrete event-oriented processes. Specialized simulation languages: GPSS, SIMSCRIPT, GASP, SIMPAC. Monte Carlo methods. Experimental design and statistical analysis of results.
J. Neilson.

• Engineering 94.502F1
Systems Feasibility and Design
Introduction to the basic techniques employed in planning and design of complex systems. User requirements. System design variables. Interaction of subsystems. Use of simulation, cost, performance, and time tradeoff. Elements of project management. Methods and approaches will be illustrated through case

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

studies, primarily in the field of information systems engineering.
J.S. Riordon.

• Engineering 94.504W1
Computer Methods in Industrial Engineering
Linear programming. Simplex method. Duality, network models and algorithms. Critical path method, PERT. Probabilistic decision models. Subjective probability, utility. Computational solutions will be emphasized.
J.S. Riordon.

• Engineering 94.505W1
Optimization Theory and Methods
This is a second level course in optimization theory and computer-oriented optimization methods. It assumes a basic knowledge of linear algebra such as may be obtained in 94.552 and a basic introduction to linear programming. Lagrange's method of undetermined multipliers. Unconstrained optimization: steepest-descent, Newton-Raphson, conjugate gradient, variable metric, and Powell-Zangwill methods. Nonlinear programming: Kuhn-Ticker conditions, saddle point theory and dual problems, computational techniques. Linear programming theory: Large scale systems, decomposition theorems. Integer programming. Function space techniques and introduction to optimal control.
B. Pagurek.

• Engineering 94.515W1
Socio-Economic System Models
The mathematical structures of models used in manpower, health care systems, input-output, econometric, industrial dynamics, technological forecasting, transportation and 'world' modelling. The uses and limitations of marker chains, differential/difference equation and linear ratio models. Judgemental modelling, including cross-impact and 'Systems Dynamics' methods. The use of model optimization in policy studies.
Prerequisites: Engineering 94.552 and 94.553.
C.M. Woodside.

• Engineering 94.516
Theory of Large Systems and Networks
Examples of networks and a description of engineering problems in their design and analysis. Elements of queueing theory and its application to network problems. Theory of networks and graphs; reliability; simulation; optimization. Application of methods and theories to engineering problems.
Prerequisites: Engineering 94.521, 94.552 and 94.553.

• Engineering 94.517W1
Queueing, Scheduling and Control of Information Systems
An intermediate level course in queueing theory, with particular emphasis on useful approximations (diffusion, heavy traffic). M/G/1, G/M/1 and G/G/1 systems; closed and open networks of Markovian queues (methods of Jackson and of Gordon and Newell, etc.). Scheduling, priority queueing, design of queueing nets and real-time control. Applications to information systems (computer scheduling, data concentrators, libraries, health care systems).
Prerequisite: Engineering 94.553.
C.M. Woodside.

• Engineering 94.518F1
Topics in Information Systems
This course is designed to introduce to the Doctoral or advanced Master's student several topics of current research in the area of information systems. Topics will include interactive video network design, scheduling and resource allocation in distributed information networks, modelling of information systems and of information flow in networks, and economics and planning of computer based information systems.
Prerequisite: 94.553 and permission of Department.
B. Pagurek and others.

• Engineering 94.521F1
Computer Communication Systems I
A first level course in computer communication systems which provides both theoretical and practical background. The course consists of two separate but interwoven streams. The first introduces basic applications of stochastic process and queueing theory to computer communication systems. The second describes various data communication applications and examines their specific hardware, software and communications requirements: telephone set,

local loop, central office, toll office and switching hierarchy, echo suppressors, analogue transmission, line equalization, different types of codes, modems, digital transmission, interfaces, error detection and connections, STDM and ATDM, optimum block size, store and forward packet switching, networks such as ARPA, terminals, controllers and concentrators, polling, loop systems, software systems and protocols for resource sharing and multiprocess access.
M.E. Ulug.

• Engineering 94.524W1
Computer Communication Systems II
A second-level course in computer communication systems and consists of two separate but interwoven streams. The first covers the advanced applications of stochastic process and queueing theory to computer communication systems. The second introduces different types of systems architectures. The following networks and their protocols are discussed: ARPA, SITA, CYCLADES, IBM's SNA, SPIDER, DATAPAC. Stochastic message flow and delays in different types of computer communication networks including the ones using satellite links in subnet are analyzed; private and shared systems are compared; the calculation of buffer sizes and overflow probabilities for different types of traffic mixes are introduced; the non-transparency of store and forward packet switched systems is discussed; a number of flow control methods are described. Finally latest developments in computer communication systems are introduced.
Prerequisite: Engineering 94.521
M.E. Ulug.

• Engineering 94.539F1, W1
Advanced Topics in Digital Systems Design
A course dealing with recent and advanced topics in the field of digital systems design and related areas. Primary references are recent publications in the field. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisites: Engineering 94.557, 94.558 and permission of instructor.
B.A. Bowen.

• Engineering 94.551W1
Estimation and Forecasting
Models for time series analysis: autogressive, moving average processes. Decision theory: hypothesis testing, likelihood ratio tests. Minimum risk, maximum likelihood and Bayesian estimators. Estimation of parameters of time series models, least squares and maximum likelihood, recursive techniques. Wiener-Kalman filters. Prediction and forecasting.
Prerequisite: Engineering 94.553.
B. Pagurek.

• Engineering 94.552F1
Advanced Linear Systems
A unified treatment of linear dynamic systems and techniques for their analysis. Review of matrix algebra and complex variable theory. Properties of linear systems. Classical solution of differential and difference equations. Transform methods; Laplace, Fourier and z- transforms. State space representation and matrix methods. Elementary functional analysis to Hilbert spaces and operators.
J.K. Cavers.

• Engineering 94.553F1, W1
Stochastic Processes
Basic concepts of probability theory. Random variables; distribution and density functions, functions of a random variable, averages, moments, characteristic functions, sequences, introduction to statistical estimation. Random signals in linear systems; power measurement, correlation, spectral analysis. Elements of queueing theory; arrival distributions, service policies, waiting times, Markov sequences, system models.
R. Pandya.

• Engineering 94.554W1
Statistical Communication Theory
Complex envelope description of bandpass signals and random processes. Analog communication systems; receiver structure, noise and bandwidth properties of AM and angle modulation. Digital communication systems; basic decision theory, common signal sets, receiver structure and white noise error probability. Channel models; channel filter, colored noise random gain, random phase.

Elective portion; topics selected from equalizers, radar, PCM, scatter transmission or others.
Prerequisites: Engineering 94.552 and 94.553.
D.C. Coll.

• Engineering 94.556W1
Advanced Stochastic Processes
Definition of a stochastic process. Wiener process, Levy's theorem, their relation to white and broadband noise. Poisson process. Processes with independent increments, process with uncorrelated or orthogonal increments. Markov processes, Chapman-Kolmogoroff equation, Fokker-Planck equations. Modelling physical processes. The stochastic integral and diffusion equations. Least square estimator; Wiener-Kalman filter, linear smoothing filter, selected non-linear estimation problems in communication and control.
Prerequisite: Engineering 94.551.

• Engineering 94.557F1
Fundamentals of Discrete Systems
Introduction to the theory and applications of discrete mathematics to the software and hardware of computers and computing systems. Algebraic structures and graphs of groups, rings and fields are introduced and relations, partially ordered sets, lattices are discussed. These concepts are then applied to unify the array operators used in combinatorial logic. Other applications include basic automata theory, state minimization, state assignment, polynomial error coding, network reliability, and the algebraic structure of languages.
Prerequisite: Engineering 94.466 or equivalent.
M.E. Ulug.

• Engineering 94.558F1
Digital Systems Architecture
The course begins with the documentation of a typical computer using DDL as a descriptor language. The architecture is extended to illustrate a variety of computer architecture. A general model of bus-oriented systems is formulated and communication protocols established for autonomous memories and peripherals. Distributed function architectures and multiple processors are incorporated into a model for analysis. Finally a variety of current system architectures are discussed from the current literature.
Prerequisite: Engineering 94.557.
B.A. Bowen.

• Engineering 94.559W1
Algorithmic Techniques and Digital Design
Design algorithms for multi-output combinatorial logic. Programming problems. Specification of synchronous sequential machines; array specifications; algorithms for state minimization; costing functions for flip-flop and combinatorial logic. The algebraic structure and design algorithms for interfaces. Computer-aided design and simulation. Asynchronous design of digital machines, state minimization and coding. The course provides experience with the use of design and simulation programs maintained on the university computer.
Prerequisite: Engineering 94.557.
B.A. Bowen.

• Engineering 94.560F1
Engineering Methods of Numerical Analysis
Methods for the computer analysis of numerical data with an emphasis on practical application of the mathematical foundations. Curve fitting: polynomials, orthogonal functions, discrete Fourier series. Data smoothing: errors, digital filtering and classical smoothing. Practical effects of round-off errors. Calculation of special functions. Fourier-series based numerical methods: fast Fourier transform and spectral analysis. Solutions of partial differential equations.
J.N. Knight.

• Engineering 94.562W1
Digital Signal Processing
Signal representations. z- transform and difference equations. Digital filters: recursive design techniques for FIR and IIR filters, quantization effects. Discrete Fourier transform: properties, correlation and convolution, chirp z- transform, number theoretic transforms, IIR filtering via block recursion. Fast Fourier transform: algorithms and implementation. Random signal analysis: estimators, sampling distributions, averaging, correlation and spectral estimates, windowing for leakage

suppression and stability improvement. Hardware and software implementations: A/D - D/A conversion, fixed point arithmetic techniques, high speed multipliers, ROM-based digital filters. Applications: speech analysis and synthesis, predictive encoding.
Prerequisites: Engineering 94.552 and 94.553.
D.C. Coll.

• Engineering 94.563W1
Communications Technology
Current engineering practice in communications systems design. The performance and interconnection of subsystems which make up multichannel transmitters and receivers. Topics to be discussed include modulation, multiplexing, solid state microwave signal sources and amplifiers, transmission systems, and receivers.
Prerequisites: Engineering 94.552 and 94.553.
D.R. Conn.

• Engineering 94.565F1
Data Communication
Channel characteristics: frequency response, noise, non-linearities, etc. of common media. Modulation methods: ASK, PSK, FSK, spectra of signals. Time-dispersive channels: distortion, equalizers, error bounds, precoding. Synchronization: phase and bit sync by phase locked loop and others; optimum frame sync; network sync by pulse stuffing, locked clocks; non-linearities. Impulse noise.
Prerequisite: Engineering 94.554.
J.K. Cavers.

• Engineering 94.566F1, W1
Advanced Topics in Control Systems
A course dealing with recent and advanced topics in the field of control systems and related areas. Primary references are recent publications in the field. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisite: Engineering 94.545 and permission of instructor.
C.M. Woodside.

• Engineering 94.567W1
Source Coding and Data Compression
Discrete and continuous sources: Markov and filtered noise models; the rate distortion functions. Discrete source coding: Huffman coding, run length encoding; text, black/white television, digitized script. Continuous sources: PCM, DPCM, and delta modulation, tolerance violation coding, Fourier and Walsh transform coding; speech, fascimile, telemetry, television. Speech compression by parameter extraction. Compression by tree coding; discrete sources with fidelity criterion, generalization of delta modulation.
Prerequisites: Engineering 94.552 and 94.553.
J.K. Cavers.

• Engineering 94.571F1
Real-Time Systems
This course attempts to illuminate and extend the principles of basic operating systems by in-depth experience with operating systems such as RT11 or RSX-11. Techniques of implementing software to perform various operating system functions; examination of the problems generated by real time operation, particularly hard deadlines, efficiency constraints, and stringent requirements for protection and recovery. The course will have a strong project orientation and will require the student to work on a computer at the university outside of class hours in cooperation with other students.
Prerequisite: Computing Science 95.401 or equivalent.
R.J.A. Buhr.

• Engineering 94.572F1
Topics in Software Engineering
Four of the following modules will be presented:
Cooperating processes
Language selection and design
Software tools
Methods of description and specification of hardware and software processes
Software measurement and validation
Operating systems
Interactive graphics
Compilers
Prerequisites: Engineering 94.574 or 94.480 and 94.481, or equivalent.
R.J.A. Buhr and others.

• Engineering 94.573W1
Integrated Data Base Systems
The purpose of this course is to present the underlying principles behind the organization of data bases and data base management

systems and to relate these principles to current practice and trends. Theory of data base organization: hierarchical, network and relational approaches; data and storage structures. Data description languages. Data base management systems: the special purpose and the host language approaches. Organization of data management software. Shared data bases. Online access and up-date. Significance of associative processing. Performance. Integrity and security. Comparative analysis of selected current systems including CODASYL/DBTG and IMS, and discussion of trends and examples. Assignments will include hands-on experience with a live data base.
Prerequisites: Engineering 94.574 or 94.480 and 94.481.
R.J.A. Buhr and B. Pagurek.

• Engineering 94.574F1
Software Engineering
A systematic treatment of the principles and techniques of software engineering as they apply to the various phases of a software development project. It is intended for students with strong preparation in applied computing science and computer programming. Students without such preparation should take Engineering 94.480 and 94.481 rather than this course. Structured programming. Top down design; hierarchial design. Module specification techniques. Decision tables. Table driven techniques. Translator writing systems. Documentation. Methods of testing and validation. Debugging-antibugging. Portability, adaptability, maintainability and reliability. Project organization and control. Feasibility analysis.
J.E. Neilson.

• Engineering 94.575W1
Software Translators and Their Applications
Introduction to the concepts and applications of translators: efficiency, expandability, correctness, and compactness; within the framework of programming language translators. Application in such areas as query and edit systems, intelligent terminals, machine to machine data translations, file translations, the design of input/output specifications. Scanners, finite state machines, grammars, parsers, code generators. A significant project to implement a non-trivial translator will be required; it will provide in-depth practical experience in software engineering: complex data structures, searching and sorting, overlaying strategies, error detection and recovery strategies, interfacing with operating systems, human engineering.
Prerequisites: Engineering 94.574 or 94.480 and 94.481.
W.R. Lalonde.

• Engineering 94.576F1
Computer System Performance Analysis
The development and application of analytical models of computer system performance. Influence of CPU scheduling algorithms on utilization, response time and throughput: scheduling algorithms depending on fixed priority, on waiting time, on service time, and on hard deadlines in a real time environment; multiprocessor scheduling; preemptive and non-preemptive scheduling; deterministic and queueing models. Effect on memory utilization and performance of management strategies for primary and secondary memory: program relocation, buffer allocation, demand paging, swapping. Scheduling for I/O devices: minimizing rotational latency and seek time. Prediction of access times to data on secondary storage via hashing, indexing, inversion, etc. Interaction of queues for various resources: CPU, memory, I/O: use of queueing network models, including multiple customer classes. Prediction of performance under limiting cases of light and heavy loading. Computational considerations.
Prerequisites: 94.517 together with a knowledge of operating system organization such as might be gained from 95.401 or 94.571.
R.J.A. Buhr.

• Engineering 94.577W1
Teleprocessing Software Design
Current theory and practice in teleprocessing software design. Review of basic teleprocessing functions and subsystems: code conversion, line control, error control, synchronization; teleprocessing devices and networks. Telecommunications access methods (TCAM-OS/VS), communications controllers, assembler and macro languages, emulation programming. Data communication systems and host computer interface configurations: hardwired

communication processors, separate front end processing, shared mass storage and parallel processing configurations. Modular software design for front end processors, message switchers, remote concentrators and intelligent terminals. Network control programs and high-level interprocess communications in resource sharing multicomputer networks
Prerequisites: Engineering 95.401 and Engineering 94.521.
S.A. Mahmoud.

• Engineering 94.579F1, W1
Advanced Topics in Software Engineering
A course dealing with recent and advanced topics in the field of software engineering and related areas. Primary references are recent publications in the field. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisite: Engineering 94.572 and permission of instructor.
R.J.A. Buhr.

• Engineering/Mathematics 94/70.582W1
Topics in Information and Systems Science
The purpose of this course is to bring together fundamental results in the new and active area of design and analysis of efficient computer algorithms for large, complex problems. Models of computation and of computational complexity of algorithms in various application areas such as data manipulation, computer networks, analysis, queueing systems, optimization, etc.

R.J.A. Buhr and F. Fiala.

• Engineering 94.584F1, W1
Advanced Topics in Communications Systems
A course dealing with recent and advanced topics in the field of communication systems and related areas. Primary references are recent publications in the field. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisite: Engineering 94.565 and permission of instructor.
D.A. George.

• Engineering 94.590F1, W1, S1
Systems Engineering Project
Students pursuing the non-thesis M.Eng. program will conduct an engineering study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented at a departmental seminar.

• Engineering 94.596F1, W1, S1
Directed Studies

• Engineering 94.599F3, W3, S3
M.Eng. Thesis

• Engineering 94.699F, W, S
Ph.D. Thesis

Departmental Program Descriptions and Details of Courses

Faculty of Science

Dean: J.L. Wolfson

The Department

Chairman of the Department: J.M. Neelin
Associate Chairman, Graduate Studies: M. McCully

The Department of Biology offers programs of study and research leading to the M.Sc. and Ph.D. degrees. The research activities of the faculty members of the Department are currently directed to three major areas:

Molecular and Developmental Biology
T.W. Betz, V.N. Iyer, P.E. Lee, M. McCully, J.M. Neelin, G. Setterfield, H. Yamazaki

Physiology
D.R. Gardner, S.L. Jacobson, K.W. Joy, J. Sinclair, J.A. Webb, F. Wightman

Ecology and Systematics
C.A. Barlow, I. Bayly, G.R. Carmody, M.B. Fenton, H.F. Howden, W.I. Illman, J.D.H. Lambert, H.G. Merriam, H.H.J. Nesbitt, D.A. Smith

The Department welcomes applications from graduates with degrees in the biological sciences. Since current trends indicate that students in the non-biological sciences (Chemistry, Engineering, Mathematics, Physics, Psychology, etc.) may also be suited to undertake valuable research and graduate work in biology, the Department encourages graduates in other scientific disciplines to apply. If admitted, such students may take additional courses in biology to make up deficiencies in their background; the completion of these extra courses will generally not require more than one additional year of study.

Graduate offerings of the Departments of Biology and Chemistry include projects and courses which may be appropriate for students with an interest or background in biochemistry.

The Department accepts part-time graduate students but cannot guarantee that they will be able to fulfill all the requirements for their degree outside of normal working hours.

The Department of Biology has cooperative agreements with the National Research Council, the Research Branch of the Canada Department of Agriculture, and the National Museum of Natural Sciences in Ottawa whereby scientists from these institutions may assist graduate students with particular research projects, subject to the approval of the departments concerned.

The studies of each graduate student will be supervised by an Advisory Committee consisting of his research supervisor and two other advisers.

Qualifying Year Program

Candidates who lack the minimum qualifications for admission to the Master's program must register in and successfully complete a Qualifying Year program.

Normally, prescribed courses will include 61.498. Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Science

Admission Requirements

The normal requirement for admission to the Master's program is an Honours degree (or equivalent) with a high second-class standing (Carleton grade point equivalent of 8 in major).

Program Requirements

The candidate will complete five approved full courses (or the equivalent) including a research thesis equivalent to a maximum of two full course credits. The thesis must be successfully defended at an oral examination.

All candidates are also expected to attend and must give at least one departmental research seminar. Candidates may be required to demonstrate a reading knowledge of one language other than English and to take certain technical or other courses.

Doctor of Philosophy

Admission Requirements

Applicants holding an M.Sc. degree from a

recognized university will be considered for admission into the Ph.D. program.

An applicant with an Honours bachelor's degree who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Ph.D. program directly. Such candidates will be required to complete at least 15 full courses, or the equivalent.

Students who have been admitted to the Master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate high promise for advanced research during the first year of the Master's program.

Program Requirements

Over a period of two years or more, the candidate must complete the following:

- ten full courses, or the equivalent;
- an oral comprehensive examination, which must be undertaken not later than one year before submission of the Ph.D. thesis;
- a research thesis equivalent to a maximum of seven of the required ten full course credits which must be successfully defended at an oral examination.

All candidates are also expected to attend and must give at least one departmental research seminar. Candidates may be required to demonstrate a reading knowledge of one or two languages other than English and to take certain technical or other courses.

Students who have been admitted to the Ph.D. program on the basis of a 15-course requirement, which will normally require three years of full-time study, must complete the following:

- 15 full courses, or the equivalent;
- a comprehensive examination;
- a research thesis equivalent to a maximum of eight of the 15-course requirement;
- the language requirement outlined above.

Graduate Courses*

- Biology 61.510T2
Advanced Plant Morphogenesis
An advanced course dealing with selected topics in plant morphogenesis.
M.E. McCully.

- Biology 61.520T2
Advanced Cell Biology
An advanced lecture and seminar course dealing with recent developments in cell biology. Emphasis will be on cell structures and molecular mechanisms involved in regulation of basic cell processes. Nuclear organization, chromosome structure, composition and replication, nucleic acid structure and function, virus organization, ribosomes, protein synthesis and enzyme regulation will be considered in detail. The course is offered jointly with the Biology Department, University of Ottawa. In addition to the regular professors, specialist guest lecturers from local government laboratories and other universities are frequent contributors. Although students are encouraged to enroll for the entire course, the first or second terms may be taken singly under the course numbers 61.521 and 61.522. Credit for Biology 61.520 precludes credit for Biology 61.521 and 61.522.
Prerequisite: A course in basic cell biology, biochemistry and/or genetics.
G. Setterfield and G. Kaplan, organizers.

- Biology 61.521F1
Advanced Cell Biology I
Course description, prerequisite and lecturers as described under Biology 61.520. Precludes credit for Biology 61.520.

- Biology 61.522W1
Advanced Cell Biology II
Course description, prerequisite and lecturers as described under Biology 61.520. Precludes credit for Biology 61.520.

- Biology 61.530T2
Plant Biochemistry
An advanced course covering selected topics in plant biochemistry.
Prerequisite: Biology 61.425 or permission of instructors.
K.W. Joy, J.A. Webb and F. Wightman.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

• Biology 61.542T2
Vertebrate Reproduction and Developmental Endocrinology
An experimental analysis of basic endocrinology, neuroendocrinology and modes of hormone action in vertebrates.
Prerequisites: Biology 61.335 and permission of instructor.
H. Robertson and T.W. Betz.

• Biology 61.545T2, Biology 61.546T1
Techniques and Instrumentation for Biologists
A modular course covering a range of techniques of interest to students in all fields of biology. Specific topics will be announced before registration. Modular exchange may be permissible with 61.565.
M.E. McCully, J.M. Neelin and G. Setterfield, co-ordinators.

• Biology 61.550T2
Selected Topics
Courses in selected aspects of specialized biological subjects not covered by other graduate courses may be offered. Course details will be available at registration.

• Biology 61.551F1
Advanced Topics
Courses in selected aspects of specialized biological subjects not covered by other graduate courses. Course details will be available at registration.

• Biology 61.552W1
Advanced Topics
Courses in selected aspects of specialized biological subjects not covered by other graduate courses. Course details will be available at registration.

• Biology 61.555T2
Advanced Insect Morphology
A course devoted to an advanced study of insect morphology and phylogeny.
Prerequisite: Biology 61.460.
H.H.J. Nesbitt.

• Biology 61.557T2
Acarology
An advanced course devoted to the Acari (mites).
Prerequisite: Biology 61.460.
H.H.J. Nesbitt.

• Biology 61.565F1, W1, S1
Field Course
A half-course involving intense, continuous study of living organisms under natural conditions. Credit is based on three weeks of full-time field work with attendant assignments, selected from several one- or two-week modules with various instructors. Costs of long-distance transport (if applicable), and room and board relating to the course are borne by the student. (Details may be obtained from the coordinator.) Persons having used Biology 61.365 for credit, may not use the modules they took for 61.365 towards 61.565.
Modular exchange may be arranged between 61.565 and 61.545.
Day Division: all day, approximately six days a week, offered at different times during the year.
M.B. Fenton, co-ordinator.

• Biology 61.570T2
Evolution and Biogeography
H.F. Howden.

• Biology 61.575T2
Mammalogy
A lecture, seminar, and laboratory course on the taxonomy, distribution, behaviour, and ecology of mammals.
Prerequisites: Biology 61.360 and 61.415, or permission of instructor.
D.A. Smith and M.B. Fenton.

• Biology 61.590T2
Directed Special Studies and Research

• Biology 61.599F4, W4, S4
M.Sc. Thesis

• Biology 61.699F, W, S
Ph.D. Thesis

Courses not offered in 1976-77 but to be given in 1977-78:
61.500 Current Developments in Molecular Genetics
61.502 Regulations of Macromolecular Biosynthesis
61.525 Plant Physiology
61.535 Special Studies in Physiology
61.548 Population Biology of Species and Communities
61.556 Advanced Insect Taxonomy

Department of Chemistry

The Department

Chairman of the Department: J.W. ApSimon
Departmental Supervisor of Graduate Studies: G.W. Buchanan

The Department of Chemistry offers opportunities for advanced study and research leading to the degrees of M.Sc. and Ph.D. At the Ph.D. level, research is currently focussed on the areas of Bio-organic Chemistry and Metal Ion Chemistry. The Department encourages part-time graduate study at the M.Sc. level, particularly for high school teachers and for government and industrial chemists living in the Ottawa area. Admission and program requirements are the same as those for full-time students, although an alternative program may be available incorporating a one-credit thesis for off-campus research.

The current research interests of the Department of Chemistry are:
C.H. Amberg, *Heterogeneous Catalysis and the Surfaces of Non-Metallic Solids*
J.W. ApSimon, *Natural Products Chemistry*
R.G. Barradas, *Electrochemistry and Electroanalytical Chemistry*
G.W. Buchanan, *^{1}H and ^{13}C NMR Spectroscopy*
C.L. Chakrabarti, *Analytical Chemistry and Atomic Spectroscopy*
J.M. Holmes, *Surface Chemistry*
J.A. Koningstein, *Raman Spectroscopy of the Solid State*
P. Kruus, *Structure and Dynamics of Liquids*
C.H. Langford, *Metal Ion Chemistry and Photochemistry in Solution*
P.M. Laughton, *Physical Organic Chemistry*
M. Parris, *Inorganic Stereochemistry*
R.A. Shigeishi, *Surface Studies of Gas-Metal Systems*
C.S. Tsai, *Mechanisms of Enzyme Reactions*
D.C. Wigfield, *Mechanistic and Biosynthetic Organic Chemistry*
R.H. Wightman, *Synthesis of Oligonucleotides and Pseudo Aromatic Hydrocarbons*
D.R. Wiles, *Inorganic and Analytical Radiochemistry*
J.S. Wright, *Theoretical Chemistry*

Joint supervision of research projects by the following Adjunct Professors is possible:
H.J. Bernstein, *Spectroscopy*
E.J. Casey, *Electrical Power Sources and Biophysics*
O.E. Edwards, *Natural Products and Mechanistic Organic Chemistry*
E.A. Flood, *Thermodynamics and Surface Chemistry*
S.A. Narang, *Nucleic Acid Chemistry*
I.E. Puddington, *Colloid Chemistry*
I.C.P. Smith, *NMR Studies of Biologically Important Molecules*

Graduate offerings of the Departments of Biology and Chemistry include projects and courses which may be appropriate for students with an interest or background in biochemistry.

For additional information regarding these areas of research or any other aspect of graduate work in Chemistry, write to the Chairman of the Department.

Master of Science

Admission Requirements

The normal requirement for admission to the Master's program is an Honours B.Sc. degree in Chemistry with at least high second-class standing. Candidates who do not qualify for direct admission into the Master's program may be accepted into a Qualifying Year program as specified in the general regulations section of this Calendar.

Preparation in the fields of Mathematics and Physics is also required.

Applicants may in some cases be required to write the Graduate Record Examinations before their admission.

Program Requirements

The specific program requirements in the Department of Chemistry are the following:
- three full courses, or the equivalent;
- a research thesis, which must be defended at a final oral examination;
- a reading knowledge of *two* languages other than English, normally chosen from French, German, and Russian.

Additional preparatory courses may be rec-

ommended if deemed necessary at the time of registration.

Doctor of Philosophy

Admission Requirements

Ordinarily, an M.Sc. degree (or the equivalent) from a recognized university is required for admission to the Ph.D. program. This program consists of the equivalent of ten full course credits.

An applicant with an Honours B.Sc. degree in Chemistry who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Ph.D. program directly. Such candidates will be required to complete the equivalent of at least 15 full courses.

Applicants may be required to write the Graduate Record Examinations before their admission. In some cases, preliminary registration in the M.Sc. program may be recommended.

Program Requirements

The normal requirements in the Ph.D. program are the following:

- a minimum of two years of full-time study and research;
- three full courses (or the equivalent) at the graduate level;
- comprehensive examination in Chemistry which will be completed approximately one year before submission of the thesis. This will normally take the form of written general examinations in all phases of Chemistry, to be taken during the first 15 months of Ph.D. enrolment, and a series of cumulative examinations in the area of specialization. These examinations are available every month during the fall and winter terms, and the candidate must pass six out of the first 16 papers attempted.
- a Ph.D. thesis equivalent to seven full courses;
- a reading knowledge of two languages other than English, normally chosen from French, German and Russian.

Students who have been admitted to the Ph.D. program on the basis of a 15-course requirement must complete the following:

- a minimum of seven full courses;
- a comprehensive examination in Chemistry, as above;
- a research thesis equivalent to a maximum of eight full courses;
- the language requirement outlined above.

This program will normally require at least three years of full-time study.

Graduate Courses*

The graduate course offerings of the Department are listed below. Several of these courses are offered in conjunction with scientists at nearby research laboratories and with the Chemistry Department of the University of Ottawa.

- Chemistry 65.509W1
Molecular Spectroscopy
Molecular electronic, rotational and vibrational spectroscopy.
Prerequisites: Chemistry 65.310 or equivalent.
(Also listed as Physics 75.522.)
J.A. Koningstein.

- Chemistry 65.517F1
Statistical Thermodynamics and Dynamics in Liquids
The more important theoretical approaches for description of liquids and solutions are discussed with emphasis on the assumptions and principles present in the underlying models.
Prerequisites: Chemistry 65.411 or equivalent.
P. Kruus.

- Chemistry 65.518W1
Experimental Methods for Investigating Structure and Dynamics in Liquids
Experimental methods are discussed with emphasis on inter-relationships between results obtained. Includes thermodynamic, transport, ultrasonic and dielectric properties together with IR and Raman spectroscopy, NMR

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

relaxation, light and neutron scattering.
Prerequisite: Chemistry 65.517F1.
P. Kruus.

• Chemistry 65.519F1
Chemical Kinetics
Theories of rates of chemical reactions with application to reactions in gaseous and condensed systems.
Prerequisite: Chemistry 65.310 or permission of instructor.

• Chemistry 65.522F1
Electrolyte Theory and Electrode Processes
Homogeneous and heterogeneous electrochemistry.
Prerequisite: Chemistry 65.430 or equivalent or permission of instructor.
R.G. Barradas.

• Chemistry 65.523W1
Electrochemical Technology
Applied electrochemistry, i.e., corrosion electro-analysis, electro-organics, batteries, novel power sources.
Prerequisite: Chemistry 65.522F1.
R.G. Barradas.

• Chemistry 65.526W1
Nucleic Acid Chemistry
A survey of the chemistry and biochemistry of nucleic acids and their components.
Prerequisites: Chemistry 65.422, 65.423 or equivalents.
R.H. Wightman and S.A. Narang.

• Chemistry 65.527F1
Physical Organic Chemistry
Reaction mechanisms in organic chemistry, linear free energy relationships and methods of approaching transition state structure. Applications of molecular orbital theory to organic chemistry.
Prerequisites: Chemistry 65.410 and 65.420 or equivalents.
P.M. Laughton and D.C. Wigfield.

• Chemistry 65.528W1
Non Proton Magnetic Resonance
Applications of ^{13}C NMR chemical shifts, couplings and relaxation times to structure and dynamics in organic and biochemical systems. Deuterium NMR and its biochemical and biological applications.
Prerequisite: Chemistry 65.422 or equivalent.
G.W. Buchanan and I.C.P. Smith.

• Chemistry 65.533W1
Biosynthesis of Natural Products
Biosynthetic routes leading to the more important classes of natural products. Methodology of attacking biosynthetic problems using radioactive tracer techniques.
Prerequisite: Chemistry 65.320 or equivalent.
D.C. Wigfield.

• Chemistry 65.561F1
Metal Ions in Solution
A study of mechanistic pathways of simple inorganic reactions including substitution, redox and photochemical. Analytical applications of kinetics will be included.
Prerequisites: Chemistry 65.310 and 65.350 or equivalent and permission of instructor.
C.H. Langford.

• Chemistry 65.557F1
Theory of Transition Metal Ions I
An introduction to the theoretical techniques of crystal field theory, ligand field theory and molecular orbital theory of transition metal complexes.
Prerequisites: Chemistry 65.310 and 65.350 or equivalent and permission of instructor.
M. Parris.

• Chemistry 65.563F1
Non Metal Chemistry
A survey of structure and reactivity, concentrating on elements in groups III A to VII A of the periodic table.
Prerequisites: Chemistry 65.310 and 65.350 or equivalent and permission of instructor.
J. Milne.

• Chemistry 65.590
Directed Special Studies
Students may register for this course more than once providing topics covered are sufficiently different to constitute separate studies.

• Chemistry 65.599F4, W4, S4
M.Sc. Thesis

• Chemistry 65.699F, W, S
Ph.D. Thesis

Courses not offered in 1976-77:
65.515 Applications of Group Theory

65.516 Quantum Chemistry
65.520 Surface Chemistry
65.521 Catalysis
65.525 Natural Products Chemistry
65.529 Synthetic Organic Chemistry
65.530 Selected Topics in Synthesis
65.531 Biochemistry of Enzyme Action
65.532 Mechanisms of Biochemical Reactions
65.555 Analytical Atomic Spectroscopy - Absorption
65.556 Analytical Atomic Spectroscopy - Emission and Fluorescence
65.558 Theory of Transition Metal Ions II
65.559 Chemical Effects of Nuclear Transformations
65.560 Reactions of Coordinated Ligands
65.562 Topics in Non Aqueous Solvents

Department of Geology

The Department

Chairman of the Department: J.M. Moore, Jr.
Departmental Supervisors of Graduate Studies: R.L. Brown, G.Y. Chao

The Department of Geology offers programs of research and study leading to the degrees of Master of Science and Doctor of Philosophy. Currently, the three principal fields of graduate study and research are:

Resource Geology
R.L. Borden, R.W. Boyle, P.A. Hill, F.K. North, W.M. Tupper, D.H. Watkinson, R.W. Yole

Precambrian Geology
K. Bell, J.A. Donaldson, E. Irving, J.M. Moore, G.B. Skippen

Structure and Geodynamics
R.L. Brown, F.K. North, G. Ranalli

Current research in the Department includes: applied geochemistry, mineral deposits, petroleum geology, experimental mineralogy, geochemistry, geochronology, metamorphic and igneous petrology, sedimentology and stratigraphy, structural analysis and geodynamics, crystallography (G.Y. Chao) and micropalaeontology (K. Hooper).

Qualifying Year Program

Applicants with a general (pass) Bachelor's degree may be admitted to a Qualifying Year program designed to raise their standing to the Honours level. Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Science

Admission Requirements

The normal requirement for admission to the Master's program is an Honours bachelor's degree, with at least second-class standing, in Geology or a related discipline.

Program Requirements

- three full courses at the graduate level (or the equivalent) in Geology, or in certain cases, in an ancillary science at the senior undergraduate level;
- informal examination by the candidate's advisory committee to determine whether or not additional non-credit courses should be prescribed;
- a thesis based on the student's own research which must be defended at an oral examination; *or*

two full graduate courses (or the equivalent) in Geology or a related discipline. This option, which requires Departmental approval, is intended for students pursuing a sequence of courses emphasizing the applied aspects of the geological sciences.

Doctor of Philosophy

Admission Requirements

The minimum requirements for admission to the Doctoral program are outlined in the general regulations section of this Calendar. The normal requirement is an M.Sc. in Geology or a related discipline.

Students who have been admitted to the Master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research during the first year of the Master's program.

Program Requirements

- a minimum of two courses at the graduate level in Geology or a related discipline;
- informal examination by the candidate's advisory committee to determine whether or not additional non-credit courses should be prescribed;
- a reading knowledge of geological subjects in a language other than English; the language chosen must be relevant to the candidate's field of research; this requirement is to be completed before the end of the second year in the Ph.D. program, and may be met by successfully completing a formal language course

or by examination within the Department of Geology;
• comprehensive examination with emphasis on areas chosen by the advisory committee in consultation with the candidate; the examination will normally be oral and will be undertaken at the end of the first year of study;
• a thesis contributing to basic knowledge in the geological sciences or related fields, which must be successfully defended at an oral examination.

Selection of Courses

The following undergraduate courses are frequently taken by graduate students and may, with the approval of the Department of Geology, be selected by Master's candidates in partial fulfillment of their degree requirements:

Geology
67.421 Metallic Mineral Deposits
67.423 Petroleum Geology
67.431 Micropalaeontology
67.442 Advanced Structure
67.451 Metamorphic Petrology
67.452 Igneous Petrology
67.463 Sedimentology
67.464 Precambrian Geology
67.482 Physics of the Earth
67.483 Applied Geochemistry

In addition to the courses offered by the Department, graduate students in Geology may select, in partial fulfillment of their degree requirements, some of the following courses offered by the Department of Geography:

Geography
45.532 Experimental Geomorphology
45.533 Periglacial Geomorphology
45.534 Aspects of Clay Mineralogy and Soil Chemistry

Through inter-university co-operation in graduate instruction, full-time graduate students registered at Carleton may arrange to enroll in up to four of the following half-courses at the University of Ottawa:

Geo 5101, 5102 Physics of the Earth I and II
Geo 5300 Engineering Geology
Geo 5305 Hydrogeology
Geo 5310, 5311 Paleontology I and II
Geo 5320, 5321 Mineralogy I and II
Geo 5330 Structural Geology

Graduate Courses*

• Geology 67.505T2
Mineral Economics
Principles of economics applied to the mineral industries. Special reference is made to the major mineral industries and to international resources, supply-demand, marketing, transportation, and financing. Economic geology of the more significant mineral industries. *Prerequisites:* Geology 67.325 and Economics 43.100, or permission of instructor.
R.L. Borden.

• Geology 67.515T2
Tectonophysics
Selected problems in structural geology, tectonics, and geodynamics, treated in seminar and laboratory sessions. Students are required to investigate and report on individual projects.
R.L. Brown and G. Ranalli.

• Geology 67.525T2
Advanced Crystallography
Principles and techniques of X-ray crystallography; interpretation of X-ray photographs and application to the study of minerals.
Prerequisites: Geology 67.221, 67.222.
G.Y. Chao.

• Geology 67.531F1, W1
Advanced Palaeontology
The morphology, classification, palaeoecology and geological history of one or more faunal or floral fossil groups. Normally the course stresses microfauna and microflora such as Foraminifera, Ostracoda, conodonts, spores, pollen and acritarchs, but arthropods (especially insects) and other macrofossils may also be included.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

Prerequisites: Geology 67.335 and 67.431 may be taken concurrently; Biology 61.360 is recommended.
K. Hooper and J. Kukalova-Peck.

• Geology 67.534W1
Palynology and Microplankton
Modern and fossil pollen, spores, acritarchs, dinoflagellates and diatomes. Field and laboratory techniques of collection and preparation. Principles of pollen analysis; interpretation of pollen diagrams. The succession of microfloras and microfaunas.
Laboratory: examination of polynomorphs.
K. Hooper and others.

• Geology 67.540T1
Tectonics Seminar
Critical appraisal of current global tectonic theories in the light of data from structure, geodynamics, petrology, geochemistry, sedimentology and palaeontology.
F.K. North and members of the Department.

• Geology 67.545T2
Glaciology
The flow and temperature regimes of glaciers and ice sheets, the classification and growth of lake and river ice, the behavior of ice under load, the diagenesis of snow and melt processes.
A.D. Stanley and others.

• Geology 67.550T2
Advanced Petrology
Interpretation of metamorphic and igneous rocks, with emphasis on phase equilibria.
Prerequisites: Chemistry 65.210, Geology 67.451 and 67.452.
J.M. Moore and G.B. Skippen.

• Geology 67.563F1
Precambrian Geology II
Review and discussion of recent literature of Precambrian geology. Comparative study of the Canadian Shield and other Precambrian Shields.
Prerequisite: Geology 67.562 or permission of Department.
J.A. Donaldson, other members of Department and invited speakers.

• Geology 67.580T2
Advanced Inorganic Geochemistry
The geochemical classification of the elements; abundance of the elements; periodic table; bonding; hydrolysis; complex ions; colloids; oxidation-reduction; diffusion; other geochemical phenomena.
Prerequisites: Geology 67.325, Chemistry 65.250.

• Geology 67.582W1
Isotope Geology
Application of isotopes to geologic problems. Review of the basic methods. Case histories. Age of the earth and meteorites. "Absolute" time scale. Stable isotopes: carbon, oxygen, sulphur. Fission track dating.
Prerequisite: Geology 67.325 or permission of instructor.
K. Bell.

• Geology 67.590T2 or 67.590F1, W1
Directed Studies
Directed reading or directed laboratory studies for full or half-course credit under the guidance of selected extramural or intramural directors.

• Geology 67.599F4, W4, S4
M.Sc. Thesis

• Geology 67.699F16, W16, S16
Ph.D. Thesis

Courses not offered in 1976-77:
67.520 Mineral Deposits
67.560 Stratigraphy and Sedimentology
67.526 Precambrian Geology I
67.583 Physics of the Earth
67.580 Advanced Inorganic Geochemistry
67.585 Physical Geochemistry

The Department

Chairman of the Department: D.A. Dawson
Departmental Supervisor of Graduate Studies: M. Csörgö

The Department of Mathematics offers graduate programs leading to the M.Sc. degree with specialization in Pure Mathematics, Applied Mathematics, Probability and Statistics; and the Ph.D. degree with specialization in Pure Mathematics, Applied Mathematics and Probability and Statistics.

The Department of Mathematics also offers a cooperative Master's Program in Statistics in collaboration with the Federal Government, emphasizing practical training through work experience along with sound training in statistical inference and basic probability theory. M.Sc. students interested in Information and Systems Science can follow a program of courses offered by both the Department of Mathematics and the Department of Systems Engineering of Carleton.

The principal research interests of the faculty include the following fields:

Pure Mathematics
Algebra: group theory; theory of rings and modules; representation theory; universal algebra; ordered structures; homological algebra; categories; commutative algebra.

Analysis: inequalities; summability; generalized integral transform; functional analysis; function spaces and algebras; operator theory; measure theory; potential theory; rings of continuous functions.

Geometry: non-Euclidean, projective and finite geometries; regular figures.

Number Theory: asymptotic theory; finite fields; analytic number theory.

Topology: structures of continuous functions; categorical topology; fixed point theory: algebraic topology.

Applied Mathematics
Compressible fluids; shock waves; airfoil theory; diffusion and convection; magnetohydrodynamics; electromagnetic and diffraction theory; special functions; asymptotic expansions; kinetic theory of gases; upper atmosphere problems; dynamics of stellar systems; numerical analysis; mathematical foundations of computing science and operations research.

Probability and Statistics
Probability theory; stochastic processes; weak and strong laws of invariance principle; goodness of fit; characterizations; multivariate analysis; operations research; distribution theory; analysis of variance; estimation theory; non-parametric methods; experimental design; sampling theory; foundations of statistical inference.

Master of Science

Admission Requirements

The minimum requirements for admission to the Master's program are outlined in the general regulations section of this Calendar. Applicants with a general (pass) Bachelor's degree may be admitted to a Qualifying Year program.

In addition, applicants may be required to write the Advanced Tests in Mathematics of the Graduate Record Examination.

Program Requirements

The two program options in Mathematics are the following:

- four full courses and a thesis;
- five full courses, without a thesis.

A maximum of two of these courses may be selected from those offered at the senior undergraduate (400) level. All other courses must be at the graduate level.

At least one of the courses must be taken in a field other than the major field of the student. Ordinarily this course should be at the 500 level but in certain cases this rule may be waived by the Chairman of the Committee on Graduate Studies.

If a thesis is written, the candidate will be required to undertake an oral examination on the subject of his thesis.

Doctor of Philosophy

Admission Requirements

The minimum requirements for admission to the Ph.D. program are outlined in the general regulations section of this Calendar.

Program Requirements

The course requirement is a minimum of three graduate courses and a suitable thesis. At least one of the courses must be chosen from those offered outside the candidate's major field.

Language requirements will be determined by the candidate's thesis advisory committee.

A comprehensive examination will be undertaken in the following areas:

- the candidate's general area of specialization at the Ph.D. level;
- any *two* areas other than the area of specialization, chosen from: (1) Algebra, (2) Analysis, (3) Topology, (4) Applied Mathematics or Probability-Statistics.

The format of the comprehensive examination will be determined by the candidate's advisory committee, but will normally consist of written and oral sections. This examination must be passed within 18 months of admission into the Ph.D. program in the case of a full-time student.

All Ph.D. candidates are also required to undertake a final oral examination on the subject of their thesis.

Selection of Courses

The following undergraduate courses may, with the approval of the Department of Mathematics, be selected by Master's candidates in partial fulfillment of their degree requirements:

Mathematics

70.401 Vector Calculus
70.403 Functional Analysis
70.407 Measure Theory
70.415 Rings and Modules
70.416 Group Theory
70.417 Commutative Algebra
70.418 Homological Algebra and Category Theory
70.425 Introduction to General Topology
70.426 Introduction to Algebraic Topology
70.427 Foundations of Geometry
70.428 Differential Geometry
70.435 Analytic Number Theory
70.436 Algebraic Number Theory
70.445 Analytical Dynamics
70.446 Hydrodynamics
70.447 Tensor Analysis and Relativity Theory
70.448 Introduction to Electromagnetic Theory
70.450 Parametric Estimation
70.451 Probability Theory
70.452 Sampling: Theory and Methods I
70.453 Regression Analysis
70.456 Non-Parametric Methods I
70.457 Testing of Hypotheses
70.458 Stochastic Models
70.470 Introduction to Partial Differential Equations
70.471 Selected Topics in Partial Differential Equations
70.472 Integral Transforms
70.473 Qualitative Theory of Ordinary Differential Equations
70.476 Special Functions
70.482 Introduction to Mathematical Logic
70.483 Topics in Applied Logic
70.485 Theory of Automata
70.486 Numerical Analysis
70.487 Game Theory

Graduate Courses*

- Mathematics 70.500T2

Analysis

Set theory, metric and topological spaces, linear spaces and functional analysis, distributions, operators, introductory spectral theory, measure and integral.

Prerequisites: Mathematics 70.301 and 70.302, familiarity with metric spaces and general mathematical ideas at fourth year level.

M.S. Macphail, A. Smith and G. Zelmer.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

• Mathematics 70.501W1
Abstract Measure Theory
Abstract measure and integral, L-spaces, complex measures, product measures, differentiation theory, Fourier Transforms.
Prerequisite: Mathematics 70.407.
L. May.

• Mathematics 70.502F1
Distributions and Generalized Functions
Linear topological spaces, countably multinormed spaces, countable union spaces and their duals, testing function spaces, spaces of generalized functions and their structure, Schwartz distributions, calculus of distribution, convolution, analytic representation and Fourier transform of distributions.
Prerequisite: Mathematics 70.403.

• Mathematics 70.503F1
Banach Algebras
Commutative Banach algebras; the space of maximal ideals; representation of Banach algebras as function algebras and as operator algebras; the spectrum of an element; special types of Banach algebras, for example regular algebras, algebras with involution; applications.
G. Zelmer.

• Mathematics 70.504W1
Integral Equations
A survey of the main results in the theory of non-singular linear integral equations; Volterra and Fredholm equations of first and second kind in the L_2 case, with special results for the continuous case; Hermitian kernels; eigenfunction expansions; compact operators.
Prerequisites: Mathematics 70.302 and 70.403.
E. Hughes.

• Mathematics 70.505F1
Complex Analysis
Complex differentiation and integration, harmonic functions, maximum modulus principle, Runge's theorem, conformal mapping, entire and meromorphic functions, analytic continuation.
M.S. Macphail and W. Schneider.

• Mathematics 70.507F1
Structures of Continuous Functions
A study of the ring C (X) of all real-valued continuous functions on a topological space X; characterization of the maximal ideals in C (X) using the Stone-Cech compactification.
K. Hardy and L.D. Nel.

• Mathematics 70.509F1
Introduction to Hilbert Space
Geometry of Hilbert Space, spectral theory of linear operators in Hilbert Space.
Prerequisites: Mathematics 70.301, 70.302 and 70.403.
E. Hughes.

• Mathematics 70.510T2, S2
General Algebra
Algebraic structures, universal algebras, lattices, direct decompositions, operator groups and rings, algebraic constructions, ordered groups and rings, normed algebras, topological groups and rings.
M. Chacron and V. Dlab.

• Mathematics 70.511T2
Theory of Groups
Abelian groups, solvable and nilpotent groups, free groups and free products, structure of finite groups, linear groups, simple groups.
J.C. Poland, L. Ribes and J.D. Dixon.

• Mathematics 70.512T2
Group Representations and Applications
An introduction to group representations and character theory with selected applications.
J.D. Dixon and B.M. Puttaswamaiah.

• Mathematics 70.513T2
Rings and Modules
Generalizations of the Wedderburn-Artin theorem and applications, homological algebra.
M. Chacron, V. Dlab, and B.M. Puttaswamaiah.

• Mathematics 70.515T2
Topological Groups
General topological groups, subgroups and factor groups, local properties, Haar integral, Lie Groups.
M. Moore and L. Ribes.

• Mathematics 70.520T2
Topology
General topology, homotopy theory, the fundamental group, complexes, differentiable manifolds, homology theory.
Prerequisites: Mathematics 70.301, 70.302, 70.310.
L. Nel and H.H. Schirmer.

• Mathematics 70.521T2
Foundations of Geometry
Various axiom systems of geometry. Detailed examinations of at least one modern approach to foundations, with emphasis upon the connections with group theory.
Prerequisite: Mathematics 70.427.
C.W.L. Garner.

• Mathematics 70.524T2
General Topology
Selected advanced topics, such as: generalizations of compactness, metrization, uniform spaces, dimension theory, categorical topology, multi-valued functions.
Prerequisite: Mathematics 70.425.
K. Hardy and L.D. Nel.

• Mathematics 70.526F1
Homology Theory
The Eilenberg-Steenrod axioms and their consequences, singular homology theory, applications to topology and algebra.
Prerequisite: Mathematics 70.425.
H.H. Schirmer and I. Pressman.

• Mathematics 70.530T2
Methods of Number Theory
Introduction to the Hardy Littlewood method, sieve methods of Brun and Selberg, character sums.
K.S. Williams.

• Mathematics 70.532T2
Algebraic Number Theory
Valuations, local fields, algebraic number fields, class number, unit theorem, extension of number fields, ramification theory, quadratic and cyclotomic fields.
R.J. Semple and K.S. Williams.

• Mathematics 70.540T2
Advanced Classical Mechanics
Hamiltonian dynamics; integral invariants; non-holonomic systems; rigid body motions.
Prerequisite: Mathematics 70.445.
M. Rahman.

• Mathematics 70.541T2
Kinetic Theory of Gases and Plasmas
Irreversible processes in gases; Boltzmann and Fokker-Planck equations; theories of Bogoliubov and of Frieman and Sandri; inhomogeneous plasmas; initial and boundary value problems of gases and plasmas; the hydrodynamic stage.
Prerequisite: Mathematics 70.445.
A. Smith.

• Mathematics 70.543T2
Mathematical Methods in Fluid Dynamics
Perturbation methods in viscous and inviscid flow. Solutions of inviscid, unsteady and steady subsonic and supersonic flow problems. Hodograph methods. Characteristic coordinates. Shock waves; rarefaction waves; interaction problems.
Prerequisite: Mathematics 70.446 or permission of Department.
P. Mandl and E.J. Norminton.

• Mathematics 70.545T2
Wave Propagation and Diffraction Theory
Mathematical treatment of wave propagation; scalar and vector waves; the diffraction phenomenon; the general diffraction problem; the solvable problems; the Kirchoff-Huygens diffraction theory; applications to microwave lenses and interferometer theory.
Prerequisite: Mathematics 70.448.
F.H. Northover.

• Mathematics 70.550F1
Multivariate Normal Theory
Multivariate Normal Distribution-properties, characterization, estimation of means and covariance matrix. Regression approach to distribution theory of statistics. Multivariate tests. Correlations. Classification of observations. Wilks' criteria.
Prerequisite: Mathematics 70.350.
D.K. Dale and E. Saleh.

• Mathematics 70.552W1
Sampling Theory and Methods II
Ratio and regression estimation theory; unequal probability sampling; multi-stage sample designs; two-phase sampling; interpenetrating samples; domains of study; nonsampling errors; related topics.
Prerequisite: Mathematics 70.452 or permission of Department.
J.E. Graham and J.N.K. Rao.

• Mathematics 70.553F1
Analysis of Variance I
The basic mathematical theory of the analysis of variance; mathematical models; estimable

functions; Gauss-Markov theorems; confidence ellipsoids; tests of hypotheses; the one-way and some higher-way layouts; analysis of covariance.
Prerequisites: Mathematics 70.450 and 70.453 or permission of Department.
D.K. Dale, A.B.M.L. Kabir and E. Saleh.

• Mathematics 70.554F1
Stationary Stochastic Processes
Introduction to stationary stochastic processes; harmonic analysis of stationary processes; estimation of the spectrum; applications to time series and communications theory.
Prerequisite: Mathematics 70.451 or permission of Department.
D.A. Dawson.

• Mathematics 70.555W1
Design of Experiments
Interpretation of factorial experiments; confounding; fractional replication; split plot, split block, Latin square, Graeco-Latin square, lattice and incomplete block designs; response surface techniques.
Prerequisite: Mathematics 70.553 or permission of Department.
J.N.K. Rao.

• Mathematics 70.556W1
Non-Parametric Methods II
Replacing composite hypotheses by equivalent simple ones; several-sample problem, locally most powerful test; method of obtaining rank tests; asymptotic distribution of linear rank statistics, power and efficiency of non-parametric tests.
Prerequisite: Mathematics 70.456 or permission of Department.
M. Csörgö and E. Saleh.

• Mathematics 70.557W1
Statistical Inference
Pure significance tests; uniformly (or locally) most powerful tests; likelihood ratio tests; tests of fit; asymptotic comparisons of tests; likelihood, Bayesian and Empirical Bayesian methods; fiducial and structural arguments.
Prerequisite: Mathematics 70.450 or permission of Department.
J.N.K. Rao and P. Tan.

• Mathematics 70.558F1
Stochastic Differential Equations
Introduction to Brownian motion and Markov diffusion processes; linear stochastic differential equations; first passage time problems; introduction to non-linear stochastic differential equations; applications.
Prerequisites: Mathematics 70.356 and 70.451 or permission of Department.
D.A. Dawson.

• Mathematics 70.559F1
Multivariate Analysis
Multivariate methods of data analysis including principal components, cluster analysis, factor analysis, canonical correlation, MANOVA, profile analysis, discriminant analysis, path analysis.
Prerequisite: Mathematics 70.450 or permission of the Department.
J. Graham and J.N.K. Rao.

• Mathematics 70.570T2
Probability Theory
Axioms, expectation and integration; zero-one law; Borel-Cantelli lemma; Kolmorgorov's extension theorem; convergence concepts, laws of large numbers, characteristic functions; weak convergence; invariance principle, Brownian motion; Markov chains, conditional expectation; martingales.
Prerequisites: Mathematics 70.301, 70.302, 70.407.
M. Csörgö, D. Dawson and R. Fischler.

• Mathematics 70.581F1
Linear Programming
Linear programming problems; the simplex method; the duality problem; other constrained optimization problems; applications to transportation, inventory and allocation models; introduction to the theory of games.
Prerequisites: A course in Linear Algebra and permission of Department.
F. Fiala.

• Mathematics 70.582W1
Topics in Information and Systems Science
Course contents will vary but will include topics drawn from information system engineering, numerical and non-numerical applications of computers, computing science, and math-

ematical systems theory. Also listed as Engineering 94.582.
Members of Departments of Mathematics and Systems Engineering.

• Mathematics 70.586W1
Numerical Analysis
Error analysis for fixed and floating point arithmetic; systems of linear equations; eigenvalue problems; sparse matrices; interpolation and approximation including Fourier approximation; numerical solution of ordinary and partial differential equations.

• Mathematics 70.587W1
Formal Languages and Syntax Analysis
Context-free languages; ambiguity; the parsing problem; parallel top-down and bottom-up methods; backtrack and n-back-track methods and suitable languages; LR (k), bounded-context and precedence grammars, relation to automata.
Mathematics 70.485 desirable; permission of Department.
F. Fiala.

• Mathematics 70.590T2
Seminars in Mathematics

• Mathematics 70.591F1, W1, S1
Directed Studies

• Mathematics 70.599F2, W2, S2
M.Sc. Thesis

• Mathematics 70.601W1
Topological Vector Spaces
Linear spaces; balanced, absorbing and convex sets; seminorms; topology, nets and filters; duality and the Mackey-Arens theorem, barrelled spaces; inductive and projective limits.
Prerequisite: Mathematics 70.403.
M.S. Macphail and G. Zelmer.

• Mathematics 70.602W1
Harmonic Analysis on Groups
Transformation groups; Haar measure; unitary representations of locally compact groups; completeness and compact groups; character theory; decomposition.
B.M. Puttaswamaiah.

• Mathematics 70.603W1
Applications of Generalized Functions
Generalized integral transforms; Laplace, Mellin, Hankel, Weierstrass, K- and Convolution transforms; generalized solutions of partial differential equations; further applications.
Prerequisite: Mathematics 70.502.
J.N. Pandey.

• Mathematics 70.610T2
Universal Algebra
Concept of a universal algebra; homomorphisms, kernels of homomorphisms, decomposition of homomorphisms; free word algebras and some of their properties; free algebras within classes of algebras; constructions of free members; equationally definable classes; polarity.
V. Dlab.

• Mathematics 70.611T2
Selected Topics in Group Theory

• Mathematics 70.612T2
Category Theory
Categories and functors. Limits. Adjoint functors. Triples and algebras. Abelian categories. Homological algebra.
I. Pressman.

• Mathematics 70.613T2
Selected Topics in Ring Theory
M. Chacron and V. Dlab.

• Mathematics 70.643T2
Mathematical Theory of Hypersonic Flow
Basic equations of inviscid, unsteady hypersonic flow. Small disturbance theory, Newtonian theory. Optimum body shapes. Blund-body theory. Hypersonic flow past oscillating wedges and cones. Hypersonic boundary layers.
Prerequisite: Mathematics 70.543 or permission of Department.
P. Mandl.

• Mathematics 70.651F1
Statistical Methods in Operations Research
Dynamic programming; modelling of physical systems by Markov chains; sequential inference problems; adaptive control processes; the principle of optimality; dynamic programming under uncertainty.
Prerequisites: Mathematics 70.356 and 70.551 or permission of Department.
D.A. Dawson and R. Fischler.

• Mathematics 70.652W1
Advanced Design of Surveys
Foundations of survey sampling; maximum likelihood and Bayesian estimation; super population and random permutation models; multiple frame theory; analytical surveys; related topics.
Prerequisite: Mathematics 70.552 or permission of Department.
J.N.K. Rao.

• Mathematics 70.657F1
Topics in Probability and Statistics

• Mathematics 70.658W1
Topics in Probability and Statistics

• Mathematics 70.690T2
Seminars in Mathematics

• Mathematics 70.691F1, W1, S1
Directed Studies

• Mathematics 70.699F, W, S
Ph.D. Thesis

Department of Physics

The Department

Chairman of the Department: R.L. Clarke
Departmental Supervisor of Graduate Studies: D. Kessler

The Department of Physics offers programs of study and research leading to the M.Sc. and Ph.D. degrees.

Some of the research in the fields outlined below is being carried out in collaboration with other institutions such as the National Research Council, the University of Chicago, Argonne National Laboratory, Brookhaven National Laboratory, and others. The current research interests of the Department are the following:

Theoretical Physics
elementary particle physics; field theory, nuclear physics; statistical mechanics (kinetic theory);

Intermediate Energy Physics
muonic atoms, both atomic and nuclear aspects;

High Energy Physics
study of elementary particle properties and interactions using major high energy accelerators; research in new instrumentation techniques (for example, streamer chambers, wire spark chambers, transition radiation detectors, etc.);

Medical Physics
radiography—the uses of external γ-rays for density measurement and for imaging of internal structures in medical diagnosis and industrial applications;

Geochronology
mass spectrometry, isotope geology; Rubidium-Strontium age determinations; isotopic abundance measurements; isotopic analysis of solids and gases;

Laser Physics
development work in transversely excited high-pressure carbon dioxide lasers, stressing the application of short high-voltage pulses to the discharge.

Carleton offers a doctoral program with specialization in high energy physics and in some aspects of intermediate energy physics (muonic atoms), both experimental and theoretical.

In addition, the Department offers a program of studies in Applied Nuclear Physics at the M.Sc. level with emphasis on Reactor Physics.

Master of Science

Admission Requirements

The normal requirement for admission is an Honours bachelor's degree with at least second-class standing in Physics or a related discipline. Refer to the general regulations section of this Calendar for further details regarding admission requirements.

Program Requirements

Each candidate will choose one of the following optional program patterns:

- three full courses (of which at least two must be in Physics and two must be at the 500 level) and a thesis equivalent to two full courses, which must be defended at an oral examination;
- four full courses (of which at least two must be in Physics and three must be at the 500 level) and a thesis equivalent to one full course, which must be defended at an oral examination;
- five full courses (of which at least three must be in Physics and four must be at the 500 level); one of these courses must be Physics 75.590. The candidate must also pass a final comprehensive examination (written or oral, or both).

All candidates except those specializing in applied nuclear physics are normally expected to select and successfully complete either Physics 75.571 or 75.572.

Candidates in the area of Applied Nuclear Physics (reactor physics) are normally expected to take and successfully complete Physics 75.553 and 75.554. One of the courses in this program must be Physics 75.590. The other three full (or six half) courses must be selected from a list of courses in Physics, Engineering or Mathematics in consultation with the Supervisor of Graduate Studies.

All candidates are also expected to attend and participate in departmental seminars and colloquia.

Language requirements, prescribed to meet the needs of each student, will be determined by the candidate's supervisor.

Doctor of Philosophy

Admission Requirements

Applicants for admission into the Ph.D. program must ordinarily have a Master's degree in Physics or a related discipline.

An applicant with an Honours bachelor's degree who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Ph.D. program directly. Such candidates will be required to complete at least 15 full courses, or the equivalent.

Students who have been admitted to the Master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate high promise for advanced research during the first year of the Master's program.

Admission to the Ph.D. program is provisional subject to satisfactory passing of a qualifying examination, which is set soon after entry.

Program Requirements

The minimum program requirements for the Ph.D. degree in Physics are the following:

- ten full courses (or the equivalent) of which at least one non-thesis course must be at the 600 level in Physics;
- a thesis equivalent to approximately one-half of the total course requirement to be defended at an oral examination;
- a comprehensive examination (written and oral) which will normally be completed prior to starting the Ph.D. thesis research;
- language requirements, as determined by the candidate's supervisor;
- attendance and participation in departmental seminars and colloquia.

Students who have been admitted to the Ph.D. program on the basis of a 15-course requirement, which will normally require three years of full-time study, must complete the following:

- fifteen full courses or the equivalent;
- a comprehensive examination;
- a research thesis equivalent to a maximum of eight of the 15-course requirement;
- the language requirement outlined above.

Selection of Courses

The following senior undergraduate courses are approved for selection by graduate students in the Department:

Physics
75.477 Introduction to Quantum Mechanics I
75.478 Introduction to Quantum Mechanics II: Applications

Graduate Courses*

Graduate students may register in the following courses, subject to the approval of the Department of Physics:

- Physics 75.511F1
Classical Mechanics and Theory of Fields
Hamilton's principle. Conservation laws. Canonical transformations. Hamilton-Jacobi theory. Lagrangian formulation of classical field theory.

- Physics 75.522W1
Molecular Spectroscopy
Spectra of simple molecules. Brief survey of atomic spectroscopy. Rotations and vibrations of diatomic and polyatomic molecules and the methods of obtaining information about the geometrical structure of the molecule and the

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter will be followed by T (for two terms).

The number following the letter indicates the credit weight of the course: 1 equals 0.5, 2 equals 1, etc.

forces acting between the constituent particles from the observed rotation and vibration spectra. Electronic structure of molecules as derived from a study of electronic spectra based mainly on molecular orbital theory. The description will be from the point of view of the experimentalist rather than the theorist. (Also offered as Chemistry 65.509)
Prerequisite: Physics 75.477 or Chemistry 65.310.

• Physics 75.542W1
Non-Equilibrium Statistical Mechanics
Boltzmann Equation: Chapman-Enskog theory. Kinetic equations for gases and plasmas based on Bogoliubov's theory. The theory of Frieman and Sandri, Divergence difficulties associated with density expansions. Formulation of the equations for the hydrodynamical stage.
Prerequisites: Physics 75.511 and 75.532.

• Physics 75.561F1
Experimental Techniques of Nuclear and Elementary Particle Physics
The interaction of radiation and high energy particles with matter. Experimental methods of detection and acceleration of particles. Use of relativistic kinematics. Counting statistics. Beam optics.
Prerequisites: Physics 75.437, 75.468 and 75.477, 75.478.

• Physics 75.562W1
Physics of Elementary Particles
Description of properties of elementary particles; pions, kaons and baryons. Conservation laws, invariance principles and quantum numbers. Resonances observed in final state interactions. Three body phase space; Dalitz plot. SU_3 symmetry scheme for classifying elementary particles, mass formulae and electromagnetic mass differences. Weak interactions; decay of neutral kaons; CP violation in neutral K decays.
Prerequisite: Physics 75.477.

• Physics 75.564W1
Intermediate Nuclear Physics
Properties of the deuteron and the neutron-proton force. Nucleon-nucleon forces, isospin and charge independence. Nuclear models: Single particle shell model, shell model with interactions, pairing, quasi-particles, collective models, deformed shell model. Scattering theory: Effective range theory, partial wave analysis, phase shifts. Interpretation of n-p and p-p scattering experiments. Interaction of nucleons with electrons. Interaction of nuclei with radiation: Multipole fields, transition rates, selection rules, internal conversion.
Prerequisite: Physics 75.561.

• Physics 75.571F1
Intermediate Quantum Mechanics with Applications
Review of the basic postulates of quantum mechanics; applications of quantum mechanics to nonrelativistic system—atoms, molecules and nuclei. Scattering theory; applications. Dirac's one particle theory.
Prerequisites: Physics 75.477 and 75.478.

• Physics 75.572W1
Relativistic Quantum Mechanics
Relativistic wave equations. Expansion of S matrix in Feynman perturbation series. Feynman rules. An introduction to Quantum Electrodynamics without second quantization.
Prerequisite: Physics 75.571.

• Physics 75.582W1
Methods of Theoretical Physics II
This is a continuation of Physics 75.581. Topics include group theory, discussion of SU2, SU3 and other symmetry groups. Lorentz group. Integral equations and eigenvalue problems.

• Physics 75.590T2
Selected Topics in Physics (M.Sc. level)
A student may, with the permission of the Department, take more than one selected topic, in which case each full course in Physics 75.590 will be counted for credit. Not more than one selected topic may be counted for credit in any one academic year.

• Physics 75.599F4, W4, S4
M.Sc. Thesis

• Physics 75.663F1
Topics in Elementary Particle Physics Phenomenology
This course is intended to develop familiarity with a wide variety of phenomenological concepts in dealing with elementary particle interactions, with special emphasis on Regge poles, cuts, absorption models, duality; inclusive reactions, deep inelastic scattering; CP violation

in weak interactions, etc.
Prerequisites: Physics 75.562, 75.571 and 75.572.

• Physics 75.671F1
Quantum Electrodynamics
Relativistic quantum field theory; second quantization of Bose and Fermi fields. Reduction and LSZ formalism. Perturbation expansion and proof of renormalizability of quantum electrodynamics. Calculations of Radiative corrections and applications.
Prerequisites: Physics 75.511, 75.532, 75.571 and 75.572.

• Physics 75.672W1
Selected Topics in Quantum Field Theory
Topics of current interest, such as unified field theories of electromagnetic and weak interactions, renormalization problems, etc. will be treated. Scale invariance, light cone singularities of current commutators; current algebras, sum rules.
Prerequisite: Physics 75.671.

• Physics 75.690T2
Selected Topics in Physics (Ph.D. level)

• Physics 75.699F, W, S
Ph.D. Thesis

Courses not offered in 1976-77:
75.532 Classical Electrodynamics
75.541 Fundamental Principles of Statistical Mechanics
75.581 Methods of Theoretical Physics I
75.660 Advanced Nuclear Physics

Officers of the University

Chancellor

Gerhard Herzberg, C.C., Dr. Ing., F.R.S., F.R.S.C.

President and Vice-Chancellor

Michael K. Oliver, B.A., M.A., Ph.D., LL.D., D.C.L., F.R.A.I.C.

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F.E. Gibson, B.Com.
K. Kaplansky, Esq.
P. Maurer, Esq.
T.R. Montgomery, Esq.
J.G. Murray, B.A., M.A.
R. Neill, Esq.
S. Ostry, B.A., M.A., Ph.D.
C.G. Watt, B.A.

Retire 1977
Hon. R.A. Bell, P.C., Q.C., B.A.
R.L. Clarke, B.Sc., Ph.D.
Jane H. Dunn
C. Edwards, Esq.
V. Garland, B.J.
G.H. MacCarthy, B.A.
D.A. Ross, B.Com., F.C.A.
F.K. Venables, B.A.
R.A. Wendt, M.A.

Retire 1978
G. Fierheller, B.A.
J.M. Holmes, B.Sc., M.A., Ph.D., F.C.I.C.
J. McGee, B.A. LL.B.
G. Paquet, M.A.
S.S. Reisman, B.A., M.A.
H. Soloway, B.A., Q.C.
I.N. Smith, O.C., LL.D.
H.L. Willis, B.A., M.Ed., Ed.D., F.C.C.T.
N. Zagerman, B.A.

Secretary
D.C. McEown, B.A., Dip. Bus. Admin.

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Dean H.A. MacDougall
Dean G. Paquet
Dean R.A. Wendt
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The following list comprises those members of the faculty of Carleton University who offered graduate courses or supervised thesis research work during 1975-76 and those who are expected by their department to do so in 1976-77. Those whose names are accompanied by an asterisk are part-time, special or adjunct appointments.

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Patrick J. Fitzgerald, M.A. Oxford, of Lincoln's Inn, Barrister at Law

J. Geo. Neuspiel, LL.B. Queen's, London, Cert. Comp. Law, Ottawa

Milada Selucka, Diploma in Law, Ph.D., Dr. Jur. Prague

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Maurice Chacron, Ph.D. Paris

Miklos Csőrgő, B.A. Budapest, M.A., Ph.D. McGill

D.A. Dawson, B.Sc., M.Sc. McGill, Ph.D. M.I.T.

J.D. Dixon, M.A. Melbourne, Ph.D. McGill

Vlastimil Dlab, RNDr., C.Sc. Charles, Prague, Ph.D. Khartoum, D.Sc. Charles

Frantisek Fiala, RNDr., C.Sc. Brno

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T. Hida*, Ph.D. Kyoto University

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Mizanur Rahman, M.Sc. Dacca, M.A. Cambridge, Ph.D. New Brunswick

J.N.K. Rao, M.A. Bombay, Ph.D. Iowa State

P. Revesz, Ph.D. University of Budapest

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A.K. Md. Ehsanes Saleh, M.Sc. Dacca, M.A., Ph.D. Western Ontario

H.H. Schirmer, M.A., Ph.D. Frankfurt

Walter Schneider, B.Sc. Columbia, M.S. Rensselaer Polytech., Ph.D. Tulane

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A. Jeffrey, M.A. St. Andrews

J.W. Leyden, B.A. Keele

R.R.A. Marlin, A.B. Princeton, M.A. McGill

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J.M. Thompson, M.A. Toronto

B.Wand, B.A. Queen's, M.A., Ph.D. Cornell

J.C.S. Wernham, M.A. Aberdeen and Cambridge, S.T.M. Union

J. Wolfe, B.A. Carleton

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A.L. Carter, M.Sc. Dalhousie, Ph.D. McGill

R.L. Clarke, B.Sc. Alberta, Ph.D. McGill

T.J.S. Cole, B.Sc. London, Carleton, Ph.D. Cambridge, A.C.G.I.

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Calendar of Milestones

The Institution

1941
The Ottawa Association for the Advancement of Learning was established to develop Carleton College. At first the College offered only evening classes in introductory university subjects, with some courses in Public Administration.

1943
The incorporation of the Ottawa Association for the Advancement of Learning.

1945
Beginning of day classes and full-time teaching in Arts, Science, Journalism and first year Engineering. Establishment of the Faculty of Arts and Science.

1946
Move from rented premises to the First Avenue campus, formerly Ottawa Ladies' College. First degrees awarded in Journalism and Public Administration.

1947
The College committed itself to develop pass and four-year Honours programs.

1949
First degrees in Arts, Science and Commerce awarded. Formation of Senate.

1950
First Honours degree in Arts and Science awarded.

1952
The Carleton College Act, 1952 passed by the Ontario Legislature. This changed the corporate name to Carleton College, and confirmed the power to grant degrees.

1952
Property for Rideau River campus acquired.

1953
Establishment of the School of Public Administration.

1954
Appointment of Architectural Associates for Carleton to prepare a master plan for Rideau River campus and to design the first group of buildings. First honorary degree of LL.D. conferred on Dag Hammarskjold, Secretary-General of the United Nations.

1955
First Master of Arts degree awarded.

1957
The Carleton University Act, 1957. Establishment of the School of Engineering. Establishment of the Institute of Canadian Studies.

1958
First Master of Science degree awarded.

1959
Move to Rideau River campus, following construction of the Henry Marshall Tory Building (Science), the Maxwell MacOdrum Library, and Norman Paterson Hall (Arts).

1961
First Ph.D. degree in Science awarded. First degrees in Engineering awarded.

1962
Southam Hall, the University Commons, Renfrew House (residence) and Lanark House (residence) completed. Paterson Hall extended and University Union opened.

1963
First Master of Engineering degree awarded. Reorganization into Faculties of Arts, Engineering, Science, and Graduate Studies. Extension to MacOdrum Library completed.

1964
The C.J. Mackenzie Building (Engineering) completed.

1965
The E.W.R. Steacie Building (Chemistry), Grenville House and Russell House (residences), Maintenance Building, and Heating Plant completed.

1966
First Ph.D. degree in Engineering awarded. The Physics Building completed (designated in 1972 as the Herzberg Laboratories). First extension to the C.J. Mackenzie Building and extension to Southam Hall completed. Establishment of the Schools of International Affairs and Commerce.

1967
Loeb Building (Social Sciences) completed. Integration of St. Patrick's College as a division of the Faculty of Arts. Integration of the School of Social Work.

1968
First Ph.D. degree in Arts awarded. First Master of Social Work degree awarded. Establishment of the School of Architecture.

1969
Controlled Environmental Facility (biology), additions to the Heating Plant and University Union (gymnasium) completed. Administration Building, Glengarry House (residence) and University Commons (residence cafeteria) completed.

1970
University Centre and Parking Garage completed.

1971
Arts Tower completed.

1972
Architecture Building completed. School of Social Work accommodated on the Rideau River campus.

1973
St. Patrick's College moves to new facility on the Rideau River campus. First degrees in Architecture awarded. New athletic complex, containing 50-metre pool and fitness centre, opened. School of Industrial Design established.

1974
Faculty of Graduate Studies expanded into Faculty of Graduate Studies and Research. School of International Affairs renamed the Norman Paterson School of International Affairs. Master of Journalism program approved for September 1974. Master of Arts program in Anthropology approved for September 1975. Master of Arts program in Religion approved for September 1975. Program leading to Certificate in Teaching of English as a Second Language established. Five year campaign fund for private support launched.

1975
Lester B. Pearson Chair for International Affairs approved for January 1, 1975. Establishment of Gerhard Herzberg Lecture Series in Science. First students enroll in Public Policy and Management Program offered jointly with the University of Ottawa.

Presidents

1942—1947
Henry Marshall Tory

1947—1955
Murdoch Maxwell MacOdrum

1955—1956
James Alexander Gibson (acting)

1956—1958
Claude Thomas Bissell

1958—1972
Davidson Dunton

1972—
Michael K. Oliver

Chancellors

1952—1954
Harry Stevenson Southam

1954—1968
Chalmers Jack Mackenzie

1969—1972
Lester Bowles Pearson

1973—
Gerhard Herzberg